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ANNUAL REPORT (1913-15

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Association of Dominion Land Surveyors

TOGETHER WITH THE

PAPERS READ AT THE

Seventh Annual Meeting

HELD AT

OTTAWA

139486
20/9/16.

on the 4th and 5th March, 1913.

OTTAWA
R. J. TAYLOR. PRINTER, QUEEN STREET.
1913

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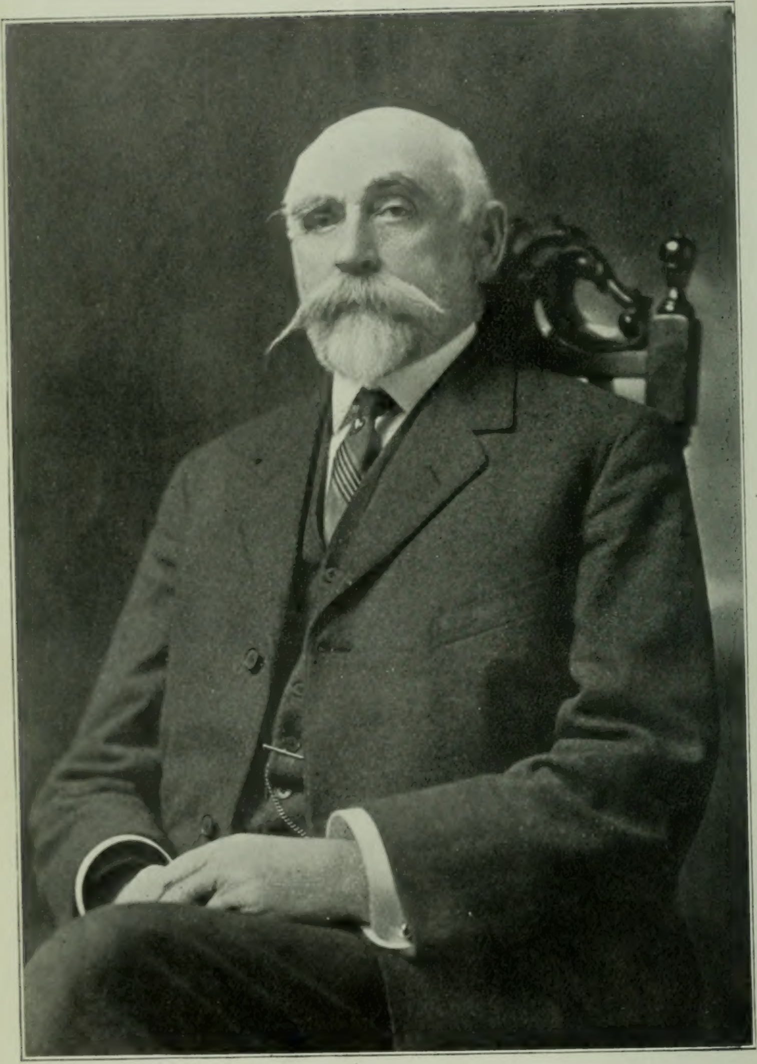

C. F. MILES, D.L.S.

PRESIDENT OF THE DOMINION LAND SURVEYORS' ASSOCIATION

CHARLES FALCONER MILES.

Charles Falconer Miles was born on the Island of Heligoland, at that time a possession of England. He was educated at Hamburg in Germany, and after leaving school learned farming on the estates of the Grand Duke of Oldenburg in Holstein. A few years later he came to Canada where his father owned an extensive farm, mostly of wild land.

In 1858 he became articled to his brother, who was a Provincial Surveyor in Ontario, and after serving the required time and passing the necessary examination, was granted a surveyor's certificate in January, 1862. The next years were lean ones for surveyors in Ontario, as but little Government work was being done. Mr. Miles visited the oil-fields of Pennsylvania, and later was engaged for a time in the woollen manufacture. In 1870 he sub-divided the Township of McMurrich for the Ontario Government, and in the following year went to the Thunder Bay District and engaged in the survey of mining claims.

His first visit to the West was in 1874, when, acting under instructions from the Federal Government, he went by way of the famous Dawson trail and made surveys of some Hudson's Bay Company's Reserves in Manitoba and what is now Rainy River District. Twice since then he has come East to engage in practice in Ontario, and twice he has retired to private life; but the lure of of the West has been too strong to resist and he has always returned. His work has been carried on in all parts of the West, and in 1906 his ability and long experience were recognized and he was appointed Inspector of Surveys, made under contract for the Topographical Surveys Branch of the Interior Department.

The position is a difficult one, requiring as it does professional skill and accuracy, untiring energy, and sound judgment. That Mr. Miles has filled it acceptably and has retained the esteem and confidence of his brother surveyors was evidenced when they elected him President of the Dominion Land Surveyors' Association for 1913.

Association of Dominion Land Surveyors

OFFICERS FOR 1913-1914.

Patron:

E. Deville, LL.D., D.T.S., Surveyor-General.

Honorary President:

W. F. King, C.M.G., LL.D., D.T.S.

President:

C. F. Miles, D.L.S., O.L.S.

Vice-President:

C. F. Aylsworth, D.L.S., O.L.S.

Second Vice-Presidents.

J. W. Tyrrell, D.L.S., Ontario.
P. T. C. Dumais, D.L.S., Quebec.
W. J. Deans, D.L.S., Manitoba.
E. H. Phillips, D.L.S., Saskatchewan.
R. W. Cautley, D.L.S., Alberta.
J. H. Brownlee, D.L.S., British Columbia.
H. G. Dickson, D.L.S., Yukon and N.W. Territory.
P. E. Palmer, New Brunswick.

Executive Committee:

F. D. Henderson, D.L.S.
D. F. Robertson, D.L.S.
D. H. Nelles, D.L.S.

Secretary-Treasurer:

E. W. Hubbell, D.L.S.

CONSTITUTION.

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ARTICLE I.

NAME OF THE ASSOCIATION.

"The Association of Dominion Land Surveyors."

ARTICLE II.

OBJECTS OF THE ASSOCIATION.

The promotion of the general interests and the elevation of the standard of the profession.

ARTICLE III.

MEMBERS.

1. The Association shall consist of Active Members and Honorary Members.

2. Active Members must be Dominion Land Surveyors, and only such shall hold office.

3. Any Dominion Land Surveyor may become an Active Member upon payment of the fees prescribed by Article IX.

4. Honorary Members must be nominated by two Active Members, and the nomination approved of by a unanimous vote of the Executive Committee. The nomination, with approval, must be in the hands of the Secretary-Treasurer at least one month before the Annual Meeting. They shall be elected by ballot in the manner hereinafter provided for the election of officers of the Association. The number of Honorary Members shall not, at any one time, exceed ten, and they shall be exempt from payment of dues.

ARTICLE IV.

1. The Surveyor General of Dominion Lands shall be Patron of the Association.

2. The officers of the Association shall consist of an Honorary President, a President, a Vice-President, a 2nd Vice-President from each Province, a Secretary-Treasurer, and an Executive Committee, all of whom shall be nominated at the General Annual Meeting.

3. Voting for officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all members on or before the 20th day of March in each year.

4. The ballots are to be returned to the Secretary-Treasurer on or before the 1st day of May, in each year, and opened by him.

5. Candidates and retiring officers are to be notified by the Secretary-Treasurer of the result of the election.

6. The Secretary-Treasurer is to have a vote only in the case of a tie.

ARTICLE V.

MEETINGS.

1. The Annual General Meeting shall commence on the first Tuesday in March, at Ottawa.

2. Special meetings of the Association may be called by the President, or by the President when requested in writing by three or more members.

3. Nine members shall form a quorum at any meeting for the transaction of business.

ARTICLE VI.

Any member of the Association who may desire a change in the Constitution of the Association, shall give notice of such contemplated change to the Secretary-Treasurer, at least one month before the next Annual Meeting, and the Secretary-Treasurer shall, in his notice of such meeting to the members, notify them of the name of the party proposing such change, and the nature thereof.

No by-law or rule shall be altered, or new one adopted, except at a General Meeting, and such amendment shall be voted upon at the said General Meeting, two-thirds majority of the votes cast being necessary for its adoption.

ARTICLE VII.

EXECUTIVE COMMITTEE.

1. The Executive Committee shall consist of the President, Vice-President, Secretary-Treasurer, and three members, and shall have the direction and management of the affairs of the Association. Three members shall form a quorum.

2. The meetings of the Executive Committee to be held at the call of the President or Secretary-Treasurer.

ARTICLE VIII.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same at the Annual General Meeting.

ARTICLE IX.

SUBSCRIPTIONS.

1. The fee for membership for Active Members shall be two dollars, payable in advance.

2. The fees of Active Members shall be forwarded to the Secretary-Treasurer with the ballot paper for election of officers, and any ballot unaccompanied by the fees mentioned in sub-clause No. 1, in case the said fee has not previously been paid, shall not be counted in the election.

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BY-LAWS.

ORDER OF BUSINESS.

1. Reading of Minutes of previous meeting.
2. Reading of correspondence and accounts.
3. Nominations for Honorary Membership.
4. Balloting for Honorary membership.
5. Reports.
6. Unfinished Business.
7. New Business.
8. Nomination of Officers.
9. Adjournment.

2. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

3. Reports of Committees must be in writing, signed by the Chairman thereof.

4. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself, subject to the discretion of the Chair.

5. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed.

6. The Chairman shall appoint two scrutineers when a ballot is taken.

7. Every member, while speaking, shall address the Chair.

8. Parliamentary Rules to govern in all cases not provided for in preceding sections.

Duties of Officers.

1. The President shall preside at all meetings at which he is present; in his absence, the Vice-President; and in the absence of both, the meeting shall appoint a Chairman.

2. The presiding officer shall only have a casting vote, not a deliberate one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

Association of Dominion Land Surveyors

SEVENTH ANNUAL MEETING.

OTTAWA, TUESDAY, MARCH 4TH, 1913.

The Seventh Annual Meeting of the Association of Dominion Land Surveyors opened this morning in the Carnegie Library.

Members present at one or more meeting:—Messrs. C. F. Aylsworth (in the chair); Dr. Deville, Dr. King, Dr. Klotz, H. G. Barber, A. J. Brabazon, S. Bray, G. A. Bennett, Senator Casgrain, T. H. G. Clunn, M. F. Cochrane, J. D. Craig, P. W. Currie, G. C. Cowper, W. Christie, A. Cummings, G. B. Dodge, P. T. C. Dumais, E. M. Dennis, M. Dennis, C. Engler, Thos. Fawcett, C. H. Ferguson, A. H. Hawkins, R. V. Heathcott, F. D. Henderson, Major E. W. Hubbell, G. S. Jones, A. Lighthall, J. J. McArthur, J. K. McLean, H. Matheson, Milliken, T. S. Nash, D. H. Nelles, A. M. Narraway, N. J. Ogilvie, Parry, Rainboth, Reid, J. T. Ransom, Robertson, T. Shanks, H. L. Seymour, Sheppard, Taggart, Teasdale, Geo. Watt, Waugh, W. R. White, R. H. Campbell, P. B. Symes, and visitors.

MR. DENNIS: Gentlemen, the time for opening our meeting has arrived, and as neither President or Vice-President is present, it will be necessary for you to elect a Chairman.

MR. HUBBELL: I move, seconded by Mr. Nelles, that Mr. Aylsworth take the Chair.

Motion agreed to.

Mr. C. F. Aylsworth in the Chair.

MR. AYLSWORTH: Gentlemen, I can assure you that I appreciate this honour very kindly, and although regretting the circumstance under which we are forced to resort to this action, I regret very much that Mr. Belanger is not with us this morning, and as I am sure we all do. However, the circumstances are such that we cannot help it, and so I can assure you that I will do my very best to have the business performed to your satisfaction.

The minutes of the last general meeting were then adopted.

RESIGNATION OF MR. BELANGER.

Mr. Dennis read the following letter of resignation which had been received from Mr. Belanger, the President of the Association:—

OTTAWA, 15TH JANUARY, 1913.

DEAR SIR:—

In accepting the presidency of the Dominion Land Surveyors' Association at its last annual meeting, I had it at heart to bring reforms which would benefit the members of our Association, and prove its usefulness.

At the same meeting, I suggested to amend the constitution so as to convert our Association into a Federal Society composed only of Dominion Land Surveyors not registered as practising Provincial Land Surveyors in any of the provinces of the Dominion; of course this amendment, if carried, would have also necessitated an amendment to the Dominion Lands Act in the same direction, in order to render eligible for Dominion Land Surveyors only the surveyors registered with our Federal Society, in accordance with the new regulations I was proposing.

Upon my request, a Committee of six members of the Association was appointed to investigate and report on the feasibility of such a scheme, but I regret to say that the great majority of that Committee could not see its way clear to report favourably, as will be seen by referring to page 77 of the Association's annual report for 1912. The reason invoked for that decision is that *"Our Association cannot interfere with the vested rights conferred by a D.L.S. certificate."*

I must admit that I do not understand the finding of the Committee in this matter; it seems to me that a D.L.S. certificate only qualifies a man to survey Dominion lands under the Minister's authority, which authority is even contested in several cases by the provincial laws. It also enables that man to become a Provincial Surveyor in some provinces of the Dominion under certain conditions, but this certificate does not oblige him to join the Dominion Land Surveyors' Association, and does not even confer on him the right to be a member of that Association, therefore, I consider the report of the Committee groundless, inasmuch as it does not apply to the subject under consideration.

I am a Quebec and a Manitoba Surveyor, and I am aware that many of the members of our Association are also qualified as Provincial Surveyors in different provinces, and, though I would be satisfied to abandon my provincial rights, I am willing to admit that it may be a hard proposition to ask my fellow brethren to desist of some of their rights in the interests of a new society, but, we must not lose sight that a large number of our brethren in profession, even among those living in the western provinces, are only qualified to survey Dominion lands, and do not care to qualify for Provincial practice; according to me, this class of surveyors is alone entitled to protection if they are to be given a chance to make a living with their profession.

I am informed that 50 to 60 per cent. of the Dominion Land Surveyors residing in the western provinces do not even care to join our actual Association; most of them have been automatically made Provincial Surveyors in a day by acts of Parliament, while by the same acts a large number of their brethren were deprived of the vested rights deriving from their D. L. S. commission, they benefit of all the provincial surveys, together with a large share of Dominion lands surveys to the detriment of many of our members, and, when asked their reason for not joining our Association, they simply say that they do not see the advantage of joining a corporation which cannot protect its members. I cannot blame them, they are right, but in justice, I claim the Dominion lands surveys allotted to these surveyors should be reserved for the members of a Federal Society, constituted as I proposed.

The main object of our Association as actually constituted, seems to be only to assemble all surveyors of the Dominion once a year to enjoy a social meeting with a few scientific lectures, together with a good dinner, after which many return home to find out they are poorer than ever and with out any hope for protection; this is certainly not encouraging and something better should be done to promote the welfare of the members of the Association.

In conclusion, I maintain that our Association should be a separate body of surveyors whose attributions would be limited to the exclusive right of surveying the Dominion lands, and that no Provincial Surveyor should be allowed to compete with us, unless he chooses to severe his connection with the Provincial Associations, and vice versa, no Dominion Land Surveyor should trespass on the provincial surveys so long as he belongs to our Association.

Having failed to carry the reforms I had at heart for the welfare of my brethren in profession, I consider my usefulness as President of the Dominion Land Surveyors' Association has ceased, and as I do not see the use of presiding any longer over an association which cannot offer any material advantage to its members, I have no other alternative than to tender you my resignation with prayer to place it before the Association at its next annual meeting.

I remain,
Dear Sir,
Yours faithfully,
P. R. A. Belanger.

E. M. Dennis, Esq., D.L.S.,
Secretary, D. L. S. Association,
Ottawa.

The Chairman: Gentlemen, what is it your pleasure to do with this letter? I would suggest that it be laid on the table for further consideration.

Motion agreed to.

THE PRESIDENT'S ADDRESS.

The Chairman: As this is an almost totally unexpected position for me to occupy, and as it has been customary for Presidents to deliver an address at the annual meeting, you will not expect one from me, but still I have taken a little anticipatory precaution and I have jotted down a few things to present to you. I trust that you will bear with me in their roughly constructed condition. It has been written: Be ye always ready, so accordingly, I was not to be caught napping, and I have placed a few notes on paper which I shall now read to you.

CHAIRMAN'S ADDRESS.

It has been written, "be ye always ready." So accordingly, I was not to be caught napping, and I have placed a few notes up my sleeve in case of an emergency.

We hear the word "Emergency" mentioned so frequently these days that perhaps we are all more alert in doing our duty. So to prevent the pages of our annual report, that are usually occupied by the President's Address, from being a blank, I have roughly and rapidly prepared a few notes that I trust may prove helpful to us at this period of our life as an Association.

Some difficulty has been experienced by those in charge of this year's programme in procuring some papers that were especially desired for this meeting, but this is not a bad sign, as those from whom those papers were desired were too busy at their work.

I regret having to report that since our last annual meeting several of our most prominent members, viz.: William Ogilvie, Lindsay Russell, Henry Lawe, Andrew Bell, M. B. Rombough, and T. H. Mackie have gone to their final reward, and of whom I trust further reference shall be made during the proceedings.

In his address at the last annual meeting, our worthy President favoured us with a carefully prepared description of the extent to which principal meridians, base lines and sub-division surveys had been completed in Manitoba, Saskatchewan and Alberta. Last year the area surveyed was extended further northwards, and settlement is following the surveys, and it is most gratifying to learn that these settlers are successful in their agricultural pursuits, and that the north boundary of our Canadian agricultural area in those three provinces remains as yet to be discovered. When we reflect that the

Dominion Land Surveyor is the pioneering forerunner of the future development and progress of the great area covered by those three provinces, we should never forget that we are a very important factor in modern civilization.

Gentlemen of the Dominion Land Surveyors' Association, it is along these lines of our professional status, with the bearing of this Association upon the same, that I wish to deal in these notes. The point is governed by Article II of our Constitution.

This Article provides that the objects of the Association are, "The promotion of the general interests and the elevation of the standard of the profession."

One often hears young surveyors remark, "Oh, what good is the Association to me?" This remark may be made on account of different reasons; may be for financial reasons; may be he feels that his modesty would prevent him from becoming a success in the Association. Then if this should be the case, these weaknesses that he recognizes in himself are the very ones that he should try to remedy. Think of the benefits to be derived from association with other surveyors from all over Canada, not forgetting that acquaintances formed in youth in many instances are the most lasting and enduring. Think of the benefits to be derived from a debating point of view, how one may cultivate a facility of concise and accurate expression. Think of it from the social point of view, how unconciously by mixing with others, he also becomes a good "Mixer," and that is a modern professional and business equipment not to be dispised; and surveyors, on account of the isolated nature of their practice, should be especially on their guard in this respect.

An author has written, "Reading makes a full man, writing an exact man." Think of the benefits to be derived from reading, out of the annual reports of this Association, how the old surveyors accomplished things and overcame difficulties. Think of the fact that the work of the young surveyor is not too humble to be presented before this Association. If it is criticised and found in error, the young surveyor will benefit most from such friendly criticism.

Let us not forget that the very nature of our work is exceptionally congenial to the development of robust characters, of strong mentality.

On the other hand, we frequently hear the old surveyor remark, "What is the use of the Dominion Land Surveyors' Association to me." My answer is, that I am one of the old surveyors myself, and I consider it a pleasing benefit to me to know all the members of this Association and to be thus enabled to brush up by the theory of the young member. Surveying is not a conservative profession any more than any other profession, the young members are scientificially developing and the old surveyors are benefitting thereby.

Some may ask how is the Association going to elevate the standing of the profession, which we should all aim at. By united consultations and comparisons we are individually better equipped for our work. Incompetent individuals reduce popular respect for the profession generally the whole profession is degraded and thereby suffers. Errors in surveying produce litigation, and a consequent undermining of our standing. "United we win, divided we fall."

Permit me to draw your attention to the list of matters contained in the circular of our Secretary, dated the 4th of February last, for discussion here, viz.:—

1. The suitability of the present contract rates for township sub-division surveys, together with any reasonable proposed increases or re-adjustments to the present rates.

2. The adaquacy or otherwise of the present salaries and allowances paid to surveyors working by the day on base lines, initial meridians, miscellaneous surveys, retracement surveys, British Columbia Railway belt surveys.

3. The rapidly increasing number of Dominion Land Surveyors, together with the decreasing amount of Dominion Lands to be surveyed.

4. What exchanges would you be interested in receiving in connection with the publication of our annual report?

5. The accuracy and value of aneroid barometer readings for obtaining differences of elevation under ordinary conditions of use on the survey of Dominion Lands.

6. Any other topic which may suggest itself to you as being of interest to Dominion Land Surveyors.

I challenge any surveyor, who is or is not a member of this Association, to successfully argue that the free and untramelled discussion of each and every item of the above list is not of vital importance to the financial and professional standing of the members of our profession.

I wish to state further, that if our Association had been a fighting machine for offensive and defensive purposes, our status in the newly formed provinces of Saskatchewan and Alberta would be much more satisfactory to-day,—because I believe that if our representative had been "in the field" during the framing of the Acts granting Autonomy to those provinces, that more favourable terms would have been secured for those of us who were not so fortunate as to be bona fide residents of those provinces, and who are thus now debarred from practising in those provinces, except by passing the examination prescribed by their regulations.

Let this be a severe object lesson to us to improve our organization for future emergencies. The provinces of Saskatchewan and Alberta are seeking to obtain control of the lands within their boundaries. When we discover the likelihood of this being consumated, I would suggest that as being our opportunity for seeking "better terms" in those provinces.

Permit me to direct your attention to the programme for this meeting, whereby you will note the names of the splendid array of talented specialists who have consented to address this meeting. Each of these gentlemen are experts of national and some of world wide repute on the subjects of which they will address us. Were it not for meetings such as this, it is probable that these gentlemen would never share the results of their matured experience with us. Who will say that these addresses will not be bristling with points of interest tending to increase our fund of knowledge of those branches of our profession.

These meetings also afford opportunities of becoming acquainted with surveyors of broader experiences, and we learn to whom we may go for suggestions and advice which results in crowning our individual efforts with success, thereby in the aggregate contributing to the elevation of the standing of our profession.

In conclusion, let us get down to "hard pan" as "the horny handed sons of toil" would express it, and bring this matter right home to us individually.

We have all been told of, or experienced the difficulties resulting from the errors of the original surveys of Ontario and the North West, the irregular original line, the uncertain chainages, the impossible bearings, the reported surveys that in reality had not been made. We have heard the jokes that have been spread broad cast concerning them, the ridicule that has been cast upon them, the endless litigation that has resulted directly from those errors of survey, driving innocent families from their homes and into bankruptcy. There is no class of litigation in Canada that has been more profitable to the lawyers than the "line fence" law suit. Believe me, I am not speaking in derogatory terms of the old surveyors, far from it, but those old surveyors do and have caused their professional successors mental trials and tribulations so exasperating that a verbal recital of them should be accompanied by the bagpipes to counter effect the resultant surcharged atmosphere.

A better class of surveys is being made to-day, and an improvement in the quality of the surveys doubtless will continue in the future, and much of this progression tendency is directly attributable to these meetings, where improvements in the methods of surveying are discussed with the sympathetic ear of the Surveyor-General, which is all elevating the standard of the profession and bringing it more into popular respect.

Future generations will bless modern surveyors on account of the accuracy of their surveys.

Organization needs no defence to-day; its the spirit of the age, and Dominion Land Surveyors would be professional laggards, compared with members of other professions, if they allowed their organization, lag behind. Hence, I trust that the young surveyor and the old surveyor will always recognize that it requires both to round off the profession, that they will both work together with their shoulder to the wheel of progress, and thereby promoting the general interests and elevating the standard of the profession.

I exceedingly regret the resignation of our President, but I trust we shall always have the benefit of his valuable assistance in furthering the best interests of our Association.

Resptecfully submitted.

C. F. AYLSWORTH, D.L.S.

MR. HUBBELL: Mr. Chairman, allow me to express my pleasure at the very able manner in which you have taken hold of this matter this morning. It further demonstrates that surveyors can at all times, when difficulties and troubles arise, no matter whether it be in muskeg or swamp, or at a meeting of this kind, they are able to rise to the occasion. Our late President, Mr. Belanger, I regret to say, has sent in his resignation on terms which he has ably put forth in the letter which has been read to you. Perhaps we do not all agree with what he says, and have had to name a successor on very short notice. I asked Mr. Aylesworth yesterday if he would do what he could to help us out, and in his usual considerate manner he has done so.

Our Chairman has brought up many points of interest to surveyors, both for the old and the young. The question of the benefit which this Association is to surveyors has been argued before this Association time and again. It is a large question, and I hope that surveyors give it their earnest consideration. If we work in unity and present just claims to the Surveyor General, and ask him for his advice and consideration, I am sure that the Association is bound to benefit by it. You, Mr. Chairman, spoke about legislation; what the Western Territories have done to our Association. I may say in connection with this that some years ago, when the Association was reorganized, one of the first words that the Surveyor

General uttered to us was to "watch legislation." Well, we have not watched legislation, it has got ahead of us. In Alberta we had a surveyor who was a member of the Provincial Parliament, I am not sure whether he was a member of our Association at the time or not, but the surveyors have to make themselves better known in order to represent the people in Parliament. It is to be hoped that in time they will enter the field.

It seems that every year we meet we miss a few old familiar faces. We have had photos taken of our annual meetings, and if you look back at those of a few years ago, you will see many faces which we now miss from our gathering, and will never see again.

In connection with the death of the late Mr. Ogilvie, whose death we all so deeply mourn, I would appreciate the privilege of saying a few words with reference to the late William Ogilvie, D.L.S.

As a man, he was a man among men, a chief among chiefs, a man of exceptional talents and resources, strong, hardy, splendid physique, of Scotch descent, he was indeed well adapted for the strenuous life he led in the northern wilds of Canada. Always to the front, with untiring energy and determination, he led many a world renowned exploratory trip in our own unknown vast possessions. His qualifications are too universally known to need dwelling upon or adding to, his capabilities, superior administrative abilities, high moral standing and professional attainments are indeed examples we may all endeavour to imitate. He was an ideal speciman of a surveyor and a credit to the profession. His sudden death is a great loss, not only to the profession, but to the country. Men of Mr. Ogilvie's stamp are few and far between, and I take this opportunity of placing on record my sincere regret for his untimely end, and sympathy for his bereaved family. Mr. Ogilvie was with us at our last meeting here a year ago, apparently in the best of health. He was ever ready to assist by advice and action to elevate the standard of the profession. Although a most capable and trustworthy employee of the Department for many years, with many and various opportunities to better his position financially, he died a poor man.

Mr. Smart, when Deputy Minister of the Interior, refers to him as follows:—"I consider it my duty to place on record here, the Department's high appreciation of the very able and satisfactory manner in which Mr. Ogilvie has discharged the important and delicate duties entrusted to him by the Government of Canada in connection with the development of the Yukon district. The marked ability and tact he has displayed at all times throughout the arduous operations, and his constant endeavour, under most trying circumstances, to properly safe-guard the interests of the

Government of this country, justly entitle him to the esteem and gratitude of the Canadian people."

I propose that the Association send a letter of sympathy to Mrs. Ogilvie. (Carried).

I take great pleasure, Mr. Chairman, in proposing a vote of thanks for your very able and apt address.

MR. McARTHUR: I would like to second the vote of Mr. Hubbell, and I would like also to add a few words of tribute to those expressed by Mr. Hubbell, a tribute to the memory of Mr. Ogilvie, and to Mr. Lindsay Russell, from the old timers. Mr. Lindsay Russell, I may say, was the father of our profession, known among us all. His great kindness, his scientific attainments, and everything else, made him a conspicuous figure, and he always endeavoured to promote the interests of the profession and lead it to a high plane of scientific work. Mr. Ogilvie was a man who did not have many advantages in his earlier years, but who developed exceptional qualifications in later life. He was a man who brought credit on himself and on our profession, and whose loss we all deeply regret.

THE CHAIRMAN: Well, gentlemen, there seems to be no more remarks to be made. I am sure we all feel keenly the loss of our old brother, and I might add that at the meeting of the Ontario Land Surveyors the other day, Mr. Russell, of Port Arthur, proposing the resolution of condolence, broke down, thus showing the affection in which Mr. Ogilvie was held by his professional brothers.

MR. DEVILLE: Mr. Chairman, I wish to propose the following motion:—

"The Association of Dominion Land Surveyors desire to express their deep sorrow for the death of Mr. Lindsay Russell, late Surveyor General of Dominion Lands and Deputy Minister of the Interior, whose skill and intelligent direction laid the foundation of the wonderful survey of Western Canada, and contributed so much to raise the standard of the surveying profession in this country. His sterling and manly qualities made friends of all those who knew him, and earned the devotion of every one who was fortunate enough to serve under him. His loss is felt by every surveyor in Canada."

Our late chief, Lindsay Russell, a son of A. J. Russell, C.E., was born in 1839. His first work was with Walter Shanly, C.E., on the Georgian Bay Canal Survey. In 1858-59, he joined the expedition for the exploration of the country between Lake Superior and Red River Settlement, under the direction of S. J. Dawson, C.E. Later he was for some time in the Department of Crown Lands.

In 1870, he was assistant in charge of construction of the Red River Road during the passage of the first military expedition to Fort Garry, under the late Field Marshall, then Colonel Wolseley, and is specially referred to in the published "Narrative" of the expedition. In 1871, Col. J. S. Dennis, who, as Surveyor General, had just inaugurated the Survey of Dominion Lands, selected him to direct operations in the field as Inspector of Surveys. Two years later he was made Assistant Surveyor General, and from that time he practically took charge of the Surveys of the Dominion, Col. Dennis' time being fully occupied with the lands' administration. It was then that he organized what was called "The Special Survey." His plan was to connect Red River to Lake Athabaska by a chain of triangles from which the meridians and base lines of the Dominion Lands' System could be started. He very properly contended that while the accuracy of the survey operations could, in a north and south direction, be controlled by latitude observations, a triangulation alone, in a country without telegraphs, could afford the necessary control in longitude. The special survey was carried from the Principal to the Second Meridian which was located by means of the triangulation. That was in 1876, a time of general depression throughout the world. Canada was not a wealthy country; the special survey was found too expensive and had to be abandoned. Like other able men, Mr. Russell was in advance of his time. The work was continued by extending the meridians and base lines much as we are doing at present, and was carried by Mr. Russell and his staff up to the Fifth Meridian. In 1878, Col. Dennis was appointed Deputy Minister of the Interior, and Mr. Russell succeeded him as Surveyor General. In 1882, on Col. Dennis' retirement, he became Deputy Minister, but owing to the rapid extension of the surveys, he was relieved of work as Deputy Minister in 1883, although retaining his rank. In 1884, he was superannuated on account of ill health. He had married in 1862, Harriet, daughter of the late Daniel McLachlin, of Arnprior. He died at his home in Arnprior in 1912. He had no family and is survived by his widow.

Mr. Russell was one of the most gifted men that it has been my privilege to know. He was a keen sportsman, a close student of languages, and remarkably proficient in the Ojibway tongue. His leisure time, when not engaged in hunting, yachting or fishing, was devoted to astronomy, in which he was remarkably proficient. It was, I believe, in 1876 that he determined the longitude of Pembina by exchanging telegraghic signals with Prof. Safford, of the Observatory of Chicago. He had a small observatory at his home; the instruments, some of them very elaborate, were made by himself in his workshop, with the sole exception of the optics. Every now and then he would come to my office, describe a new instrument which he was building, and ask me to order such and such lenses for him. His last years, unfortunately marred by the gradual loss of his eye sight, were spent half in the bush and half in the observatory; he was never so happy as when alone in the woods, especially in winter time. His most remarkable characteristics, however, were his kindliness, unselfishness and lofty ideals. Those who, like me, were fortunate enough to serve under him, can bear witness of his untiring efforts to promote their interests. I have never known a man whose friends were so absolutely devoted to him among these friends were men with world wide reputations and their devotion was just as great as that of the humblest ones. His loss is keenly felt by all those who kenw him, but by no one more than by me. He was one of the dearest friends I ever had.

Mr. Hubbell: Mr. Chairman, it so happened that I was present in the House of Commons in June, 1891, when Sir Wilfred Laurier, then leader of the Opposition, delivered in glowing and eloquent terms, his tribute on the death of the Rt. Hon. Sir John A. Macdonald.

In my opinion, as a speech, it was his master-piece, and the subject was one on which he was thoroughly qualified to speak. I never expected to again hear a man speak of another in such heartfelt expressive language.

To-day, Dr. Deville, our Surveyor General has excelled himself. His beautiful tribute to his life long friend, Mr. Lindsay Russell, expressed in terms of endearment and praise such feelings as can only be really felt by one who has lost a very dear personal friend and comrade.

Dr. Deville was closely associated with Mr. Russell in many and varying experiences in scientific subjects, as well as in matters of every day life. They understood each other thoroughly, and I think most of us realize what it means to lose one who has been very close to us, I can say no more, but hope I am in order to second Dr. Deville's eloquent resolution.

Mr. Aylsworth: As this is a very important subject, gentlemen, I will not put the resolutions with reference to Mr. Ogilvie and Mr. Russell together, but I will ask you what you will do with the resolution as to the late Mr. Ogilvie.

(Resolution carried).

Now, the resolution with respect to the late Mr. Lindsay Russell. We were all very pleased to have heard the reminiscences concerning Mr. Russell, that have been uttered by our Surveyor General, and

I will ask what is your pleasure, gentlemen, concerning that resolution.

(Resolution carried).

Mr. Aylsworth: I think it would be well for the members to pass a resolution of condolence to the families of the other members mentioned in the address.

Mr. McArthur: I beg to propose a vote of sympathy to Mrs. Mackie. Mr. Mackie was a young man connected with the Association, and life was just opening up for him when he was called away. We regret his death very much, it has cast a gloom over the whole staff.

Mr. Aylsworth: Gentlemen, it has been moved that a resolution of condolence be sent to the family of the late Mr. Mackie. —(Carried).

Mr. Dennis: Mr. Chairman, I beg to present the following reports:—The membership report, the honorary membership report.

Membership Report.

Horanory Membership:—

Honorary Patron.
Honorary President.
Six honorary members.

Members, March 5th, 1912.	168
New Members added.	38
	206
Removed by death.	2
Elected honorary members.	2
Present number of active members.	202

Deceased members, nine.

Mr. Hubbell: Is that an increase in membership over last year?

Mr. Dennis: Yes, 34. There were 38 new members, two were elected honorary members, and two died, a net increase of thirty-four.

The Secretary then read the financial report.

FINANCIAL REPORT.

Receipts.

March 3rd, 1912, balance on hand	$500 79	
Advertisements in report	41 50	
Dinner tickets sold	54 00	
Fees for 1911	46 00	
Fees for 1912	150 00	
Fees for 1913	46 00	
Government grant	125 00	
Excess Commission	10	
Interest on bank balance	10 64	
		$974 03

Expenses.

Lantern and attendant at last annual meeting	$6 00	
Entertainment and music at annual dinner	44 00	
Services of Stenographer	85 00	
Russell House, bill for dinner	85 50	
Voted to Secretary for 1911-1912	50 00	
Printing report and circulars	244 15	
Commission on cheques	1 15	
Postage and small items	25 13	
Balance	433 10	
		$974 03

Audited and found correct.

Carl Engler, *Auditor.*

March 3rd, 1913.

Note.—450 copies of the annual report were printed.

The accounts have been audited by Mr. Engler; the other auditor, Mr. Burgess, has left and is now residing in Vancouver.

Adoption of report moved.

The Chairman: I am sure we are pleased with the report just read. I like the statement regarding $10.00 interest, that in a financial report shows the money of the Association in the bank drawing interest. It has been moved that the report be adopted, is that your pleasure?—(Carried).

Mr. Dennis: I have here a letter from J. N. Wallace, D.L.S., proposing to amend Article 4 of the Constitution.

P. O. Box 1714,
Calgary, Alta., Feb. 23, 1913.

E. M. Dennis, Esq., D.L.S.,
Secretary, D. L. S. Association,
Ottawa.

Dear Sir:—

The following remarks are in reference to a proposed change in the Constitution whereby the Second Vice-Presidents for each Province would be elected by the resident members of the particular province.

As to the general question, the object of such a change is two fold: first, to enable the different sections of the country to express their views more prominently than if the Vice-Presidents are, as at present elected, or rather appointed, at the Annual Meeting, and, secondly, to create a more general interest among members distant from Ottawa.

As to the general question, it might be urged that such officials are general and should not be elected locally, but by all the members. This is not an important objection. Such Vice-Presidents are appointed chiefly for local interests or they have no meaning at all, and in any case their position is only of an advisory nature. They have no more power than any ordinary member to affect the Association as a whole. I feel sure that so far as western members are concerned, such a change in the Constitution would meet with general approval.

I think it may be taken as an axiom that very little practical interest is taken in the Association at present in the Western Provinces. Mr. Belanger suggested last year that membership should be restricted to those Dominion Land Surveyors who had no connection with any Provincial Association. To my mind the great trouble is not that the Western members would offer any objection to such a rule, but that they would offer no objection at all. I do not think their absence would benefit either themselves or the Association, but the fact is, they would make no effort at all to oppose their being excluded.

I do not wish to appear as a defender of certain acts of the Provincial Associations. So far as the Alberta Association goes, there is little love lost between it and myself. Its whole end and object at present seems to be in connection with fees and tariffs, and I rather suspect the other Provincial Associations do not greatly differ. The attitude of 75% of the western surveyors towards the Dominion Land Surveyors' Association is comprised in the question:

"If we join, will it raise the contract rates? If not, what use is it to us?"

The general question is, therefore, not whether the western members should be excluded (they are only too ready to be excluded), but is it in the interests of the profession to encourage their being members? The fact must be faced that at the present time any attempt to keep the Association up to its intention of raising the general standard, must come from eastern members. A speaker at the last annual meeting spoke well and truly when he said,—"These Western Surveyors, they think of no one but themselves." The west has its good points, but the slightest encouragement of any high ideals is not a very marked one at the present time. If the Association is to advance anything in the profession except questions of fees and rates, much the greater part of the burden will have to be carried by those who reside in the east. I do not defend this. I only state what I believe to be the facts.

As to the question of the Association placing itself on record as chiefly existing as a defender of Dominion Land Surveyors against Provincial encroachments; I consider it would have a good deal of justice on its side, but I do not think it would gain anything. The question of what would happen if the Dominion lands now within Provincial limits passed to the Provinces, but do not think that an Association formed of Dominion Land Surveyors exclusive of those who are also Provincial Land Surveyors, would have any more influence than the Association as at present constituted.

The question is a hypothetical one anyway, and in the meantime I think more would be lost than gained by dividing the existing Land Surveyors against each other.

If the general principle of having the Vice-Presidents elected in each Province is approved, I would suggest the following details be left to some small Committee:—

1. Definition of residence,—it should not cover an agency or office, or locality of work, but the bona fide home of the Surveyor only.

2. Any two residents should be enabled to propose and second a resident as Vice-President and forward same to the Secretary, who should send out a list of all names so nominated to be ballotted for. If there was only one name, of course, there would be no ballot. If there was a tie the Executive could select one of the equal ones.

3. A stated interval should be allowed for the return of a ballot, at least a month, and if the previous Vice-President held office till

the nxet was elected, the whole ballot could take place subsequent to the general meeting, though I think the names should be nominated before the meeting takes place.

Yours truly,
J. N. Wallace.

The Chairman: If I might be allowed to suggest, it might be better to have this followed up by the members according to the constitution, I think it could be changed.

(Reads Section of constitution).

Mr. Hubbell: I must say that when we were organizing this Association, it was my own idea of appointing the 2nd Vice-Presidents for the different provinces, but I think the Association will be only too glad to have these Vice-Presidents elected by the provinces, and give them every opportunity and latitude we possibly can. By all means get them interested. I support Mr. Wallace's motion.

The Chairman: Dominion Lands Surveyors seem to be in a different position from any other profession, in as much as when ballots are sent out the most of the members would be out on duty, and it is most difficult for surveyors to attend to such matters and give them consideration when they are out in the bush, and they seem to be very unfortunate in this respect. Gentlemen, you have heard the resolution, is it your pleasure that it pass?

Resolution carried.

Mr. Dennis: I have quite a few letters here on some of the other subjects mentioned in my circular. Here is one from Mr. S. Bray, Chief Surveyor of the Indian Department, in reference to No. 3. The rapidly increasing number of Dominion Lands Surveyors, together with the decrease in the amount of land to be surveyed. He says:—

(Letter of Mr. Bray read).

There is another letter from Mr. C. J. Higgins.

(Letter read).

In this respect, Mr. Henderson suggested that as contractors are now asked to report on timber and water powers in their contracts, these two subjects should be added. The Ontario Land Surveyors have a paper on botany and timber.

The Chairman: Would anyone like to offer any suggestions, as this is an important matter.

Mr. J. W. Hawkins, Dominion Lands Surveyor of Winnipeg, says: "Kill off all those who do poor work."

Mr. Dennis: We have no jurisdiction in this at all. We could move a resolution to the Board of Examiners, but we have no jurisdiction over the Board of Examiners. We could give them advice if they would take it.

The Chairman: As the subject is an important one, perhaps it would be advisable to appoint a committee to bring in a report before the meeting closes.

Mr. Hawkins: I have not thought very much of it yet, but I would be glad to hear something more about it.

Mr. McArthur: Perhaps a suggestion might be to arrange with the Board of Examiners and have them settle it.

The Chairman: The Board of Examiners certainly can settle it. Have any of the younger members any suggestions to offer?

Mr. Taggart: Mr. Chairman, it seems to me this is an important subject and as suggested by yourself, I think a Committee should be appointed, and I would move that we leave it in the hands of the Executive to appoint a Committee and to have them report on the matter to-morrow.

The Chairman: Has any other member anything to offer?

Mr. Hubbell: What are the points you wish to have discussed, Mr. Chairman, by the Committee?

Dr. Deville: To see if the examination should be stiffened up a little bit.

Mr. McArthur: I don't think any action taken by this Association would have any effect, but if the matter appeals to the Surveyor-General, and if he places it before the Board of Examiners, something might be done, otherwise it is no use having a resolution.

Dr. Deville: In the first place, the examination cannot be changed without an amendment to the Act. The Board cannot examine candidates on anything that is not in the Act. For instance, it was suggested that there should be an examination in water powers; that cannot be done at present; the Act would have to be amended first. Whether it should be amended and the standard of examinations raised, is a question for the Examiners to consider. I don't think the Board would have any objection to it; there is a tendency wherever you go, to make examinations more exacting, and it might be as well to do it for the Dominion Lands Surveyors' examinations. If a Committee is appointed, I think it should not consist of members of the Board, because in the natural course of events, any resolution that is passed by this Association, recommending some change in the examinations, will be referred to the Board of Examiners for report. The Board of Examiners should not be asked to report upon their own report.

The Chairman: Gentlemen, this is a delicate subject, and delicate in more ways than one; delicate from the point of view of the Association, and delicate from the point of view of the public, and I think the suggestion that has been made that a Committee be appointed is a good one, and that they collect all the facts, give them consideration, and bring in their report. I am sure that if it is practicable, the Board will take it into consideration. It has been suggested that I select a Committee, and I would suggest the Chief Inspector of Surveys as well as Mr. Hawkins, Mr. Nelles, and Mr. McArthur.

Mr. Hubbell: I think, Mr. Chairman, that with your permission I will not be on this Committee. The younger members should attend to it; I think it is up to them to hold a meeting and present their recommendation to the Board of Examiners.

Mr. McArthur: I think that if Mr. Hawkins, Mr. Nelles, and yourself compose the Committee, it will be sufficient for us to draw up the report.

The Chairman: It is always the way, the same old way· those who can do the most will generally do the least. Still, if it is your pleasure, I will certainly do my share. Is this your pleasure, gentlemen?—Carried.

Mr. Dennis: I have a letter here from Mr. Garner, who wrote us last year. There is some discussion of his letter in the Annual Report.

(He reads letter).

I have a letter here from Mr. Rorke, the Secretary of the Association of Ontario Land Surveyors, in connection with exchanges.

(Reads letter).

Two or three other gentlemen have written stating they would like the Ontario Land Surveyors' Report. I have their letters here.

The Chairman: Perhaps it would be well to have the Secretary correspond with them and ask them upon what terms they would exchange their Ontario Land Surveyors' report with the report of the Dominion Land Surveyors. I had an interview with them some time ago and they told me they would be willing to exchange reports on fair terms, but in the meantime they have evidently been considering the matter and have come to another conclusion. Their report is probably twice as large as ours, or a little more. I think it would be a very useful report for the Association, because it contains a great deal of information on surveys and engineering works, and would be a valuable acquisition to our libraries, but I don't think that the terms are quite fair. Perhaps it would be well not to decide the matter here, but to let the Secretary take up the matter with them and see if better terms cannot be arranged, and exchange reports with them.

Mr. Nelles: I think we should endeavour to make our report a good deal bigger than it is. It is only a matter of getting a lot of fellows to write on subjects, and in our Association we have surveyors engaged in all classes of work, and it should be an easy matter to get them to present papers, not to be read before the Annual Meeting, but to be published in the report, and to get papers written by the Dominion Land Surveyors. If we have a live sub-committee on Papers, who would go after and get papers, it will be a real benefit and make the Annual Report better and bigger than the Ontario Land Surveyors, because we have members in our Association engaged in every class of survey work.

Mr. Dennis: I might recall in that connection that the Ontario surveyors exchange reports with a number of American Associations.

Mr. Nelies: We have some $400.00 odd dollars in the bank with which to advance it.

Mr. Chairman: Would it not be well in a way to follow the practice of the Ontario Association? I think they have excellent papers in connection with surveying and engineering, and perhaps if we followed some such practice as that we might make our report larger and very much more interesting.

I am not an authority on the matter, but we have gone further into this matter than we expected; however, I fortified myself by bringing down two of the Ontario Land Surveyors' reports, and two of their exchanges. They are very large ;books, contain a great deal of information, and they are mostly of an engineering nature. Perhaps a great many of the surveyors in the West are going into engineering, and these would be very beneficial to them. I think it would be a good idea if we could get exchanges from both these States, Ohio and Illinois, and get Ontario Land Surveys reports. I think it is a good idea of Dr. Deville's to have the Committee appointed to look into this matter.

Mr. Nelles: The Association itself does not appoint sub-Committees, the Association elects, as a rule, a general Committee, and the Committee in turn appoints a sub-Committee from amongst its members, and they are empowered to take these matters into consideration. We have a number of surveyors in Western Canada and elsewhere, who if they could be persuaded to contribute articles on the various classes of surveying work, would be a great aid in preparing larger and better annual reports. There is no reason why we should not have these papers if they can be persuaded to contribute them, but they don't always want to.

The Chairman: I think the suggestion is a good one to take this matter up with a Committee.

Mr. Nelles: My experience in Committees has been that if you want a good live Committee you have to get a good working Committee from the general membership, and in that Committee there must be one man who is specially gifted and capable, and that one man does practically all the work of the Committee. In order to get a good Committee you have to get one or two men who will do the major part of the work. As regards sub-Committees, the more they are the more work is done. My idea is that the general meeting elect the Committee. The Committee thereupon meet and appoint sub-Committees. The Association as a whole do not appoint the sub-Committee. The Committee have a meeting and appoint their own sub-Committees.

The Chairman: I may say that the procedure here this morning is the one that has always been followed, to appoint such a Committee from amongst the members in attendance, and I think that it is properly in order to nominate such a general Committee now.

Mr. Nelles: The members of the sub-Committees if appointed now may be on the general Committee.

The Chairman: It makes no difference as long as they are drawn from amongst the members.

Mr. Nelles: If we are going to have a live Committee working all together, a Committee of the whole, they don't want any other Committee interfering.

The Chairman: My idea is that a Committee be appointed to bring in a report before the adjournment of this meeting.

Mr. McArthur: Isn't it generally the case that the subjects which interest the Association are classified and that the Committee is appointed to deal with them.

The Chairman: Well, Mr. McArthur, that certainly is good in theory. I have suggested to Mr. Nelles that a Committee has always been appointed at the meeting. I must say that in theory you are quite correct. It is so in the Ontario Land Surveyors, they have a Committee on papers, another on entertainment, and so on, on all matters connected with their profession, and each one of these Committees report, but unfortunately we have not arrived at that stage yet and in the meantime it might be a good thing to get advice along that line. It certainly would be very beneficial to have more papers.

Mr. Nelles: If we want a live association, I think it is about time we got down to a business basis. For instance, a general Committee is appointed, and they appoint sub-Committees; in order to get good work from a man, you must make him a specialist. You must be a specialist in order to be a success, and that is so in Committee work as well as in everything else. If we have a specialist in each of these sub-Committees who makes suggestions which others carry out, in that way each man is working for his own interests, and tries to get more papers for his sub-Committee, so that in that way the interests of all the sub-Committees are advanced.

The Chairman: If you will permit me to throw out a suggestion, as this subject is looming up large and we are all interested in it. I think it is a good idea to get these exchanges, and I know the value of them, but it would be a good idea to adjourn this debate, and if we wish to take it up again after I have brought along the papers, we can do so.

Mr. Taggart: Do I understand that Mr. Nelles made a resolution or put a motion to have a Committee appointed from the Association?

Mr. Chairman: We had better adjourn the debate and if someone will move a resolution we can get in order again. Mr. Nelles, will you move a resolution that we adjourn the debate on this subject?

Mr. Nelles: I move that we adjourn the debate on this subject until to-morrow morning.

(Resolution carried).

Mr. Hubbell: When do you intend, Mr. Chairman, to read the correspondence now before the Secretary?

Mr. Dennis: There are quite a few letters about the contract rates.

Mr. Hubbell: If we don't read them now when will we have them?

Dr. Deville: I beg to table a letter from Mr. J. L. Cote, together with a memorandum.

(The Secretary read the letter and resolution).

Mr. Dennis: I have further letters; they don't go into the subject as fully as that. Mr. C. J. Higgins writes from Vancouver.

(Letter read).

Mr. Blanchet writes from Prince Albert.

(Letter read.)

Mr. R. W. E. Loucks writes from Saskatoon.

(Letter read).

I have also a letter from Mr. George Edwards.

(Read letter).

Mr. Heathcott, from Edmonton, writes:

(Letter of Mr. Heathcott read).

(The Secretary also read letters from Mr. Roy, and Mr. T. D. Greene).

The Chairman: Gentlemen, we have certainly heard some very interesting correspondence, interesting to the whole profession, but especially to the contractors. What is the pleasure of this Association as to the correspondence?

We have contractors here, who are interested in this matter, and it seems to be the feeling of the surveyors that it is a subject for contractors, and if a Committee is appointed, it should be a Committee of contractors.

Mr. Hubbell: Mr. Chairman, this is a subject which has been brought up time and again before the members of the Association, and we have tried to deal with it time and again, but ineffectually. There is too much for us to undertake here in this correspondence at one time, the matter has to be dealt with by a Committee, a Committee appointed of contractors, and I would be very glad to give my experience and the benefit of it to the Committee. I know by experience and from what I have been told, that there is a great deal of trouble about this subject. The surveys are not the same at all, even as they were five years ago. We are getting further and further away in the woods, the contractors have only one classification, bush interspersed with muskeg. The three classifications are not feasible: prairie, light bush and heavy bush. Some years ago, I suggested a scheme to the Surveyor-General and it was thought not feasible. We know the price of provisions has gone up, labor has increased. We must have good men, and they will not take the same figure that they did years ago; they want butter, they want bacon, not salt pork, and they will leave at a moment's notice because to-day there are so many lumber camps, so many railway camps, and construction camps, that there is a great demand for labor, a demand that cannot be supplied. I remember when in Winnipeg last October, I went to an employment bureau to get a couple of men. They asked me what price I was paying, and I answered $45.00. Well, they said, do you see that list on the wall? We want 500 men and we are giving $3.00 and $4.00 a day, and all laborers, ordinary laborers. Now this state of things exists all over the West; labor is higher, forty, fifty, yes sixty per cent. higher; horses are higher; everything we eat or touch is higher, and this is a question, as I say, that cannot be settled off the bat. We have the Surveyor-General here, we cannot hold him down and say: you have to do this and that. The Committee must present this to the Surveyor-General in proper form for recommendation. Let us do it, not in a hurry, but carefully. I think at least the Secretary should answer this gentleman's letter and say that the matter will be considered by a Committee. I think that is the best thing to do. And now I would like to hear from the Western members. Get busy when you come down here, we will help you, and don't go away and say you haven't had an opportunity of expressing yourselves.

Mr. McArthur: I would like to hear from some contractor who has made some money in contracting.

Mr. Heathcott: In 1908 I made some money. I had a contract of six townships and I cleared over $5,000.00 out of it. It was ten days' trip from the railway, but I had good men; it is impossible to get them now. I think the point of accessibility that Edmonton surveyors have taken up is hardly to the point. Of course, from my experience, the further away we have been from railroads, the better men I have had, because they could not get back again; if they did not work they had ten day's walk back, and they had something to think about. In 1909, I made $2,500.00; I was closer to the railways; in 1910, I was right on the railroad, and I really don't remember what I made, but it wasn't very much. In 1911, as I said in my letter, I lost $1,000.00 in actual cash; I was running a camp and I had 85 men. They used to let me pay their transportation to the end of steel and then go and work for a contractor at $3.00 and $4.00 a day.

With regard to taking this matter up, Mr. Hubbell said it was a matter that couldn't be got into at once, that it needed a great deal of consideration. I don't think that it needs very much time;

I think if several contractors got together they could agree on reasonable rates in an hour or two and present them to the Surveyor-General and discuss them with him. I think that about $40.00 or $41.00 a mile; the rates I stated in my letter would amount to about $41.00. I think that would make all the difference between losing and making money, and I would propose that a Committee be appointed to at once take this matter up, as most of the contractors from the West, like myself, will only be here for a day or so.

THE CHAIRMAN: Are there any other contractors here.

MR. TEASDALE: I haven't been contracting this last year, but up to that time I had been since 1906. I contracted in northern Manitoba and while there I used Indian labor, and I will say that they were the best men I ever had in bush work. In 1910 I had a contract on the north line of the C. N. R. and while there I had one township two miles south of the line; it cost me a good deal more than in any other contract I was on. There were townships where I had to recut the north and south boundaries and it took all the profits I made to recut that line. I think that is one thing in locating the meridian, we have to run a trial line and in nineteen cases out of twenty that line has to be recut and we have to put more work on it. I have to have the trial line drawn and go over it and take east bases, and be sure if they have it east or west of the line. I think, of course, in most of the work at the present time we should have an increase in the rates and also payment for the recutting of the meridian of the north and south boundaries of the township, whatever case it is.

MR. DUMAIS: I may say that I have been a contractor but for three or four years, I have quit contracting on account of the small profits and high wages that had to be paid. I think the rates paid to contractors for the work should be raised at least thirty-three or fifty per cent.

THE CHAIRMAN: If you will permit me, gentlemen, to give a little history, I can remember the time when it was the Surveyor-General's feeling that all the work should be done by the day. After a few years of this practice, along came surveyors, saying there wasn't any money in work by the day. They preferred contracts to make big money, get their work done soon, and get home to spend the rest of their days with their families, and so there seems to be some feeling against the Surveyor-General because he does not recommend higher rates, but if you will pardon me for saying so, it looks as if his hands are tied under these circumstances. There is no doubt a strong case has been made that higher rates should be paid; as the Chief Inspector of Surveys has said, everything has increased, the high cost of living, the high cost of horses and transportation, these things are higher than they were a few years ago, and I can see that the matter is a serious one. If the Surveyor-General had been permitted to have all the work done by the day, these troubles would not have occurred, and it seems to me that we surveyors have brought a whole lot of this difficulty on ourselves. Mr. Teasdale and Mr. Heathcott may not remember these things, but I think they are true.

MR. HEATHCOTT: That is some time ago?

THE CHAIRMAN: Fifteen years ago.

MR. HEATHCOTT: We must consider the facts as they exist to-day. Most of the contractors are men who have gone into surveying since then, assuming that contracting would go on, I suppose.

MR. MCARTHUR: This recalls to me the conditions under which early contracting was done. In 1880, I think the rates were $5.60 for prairie, $9.00 for scrub, and $11.00 for bush. In those days, it was a horse and cart proposition from Winnipeg; you didn't get there in a Pullman car; it took three weeks or more to reach our work. Wages at that time were $1.00 a day, $26.00 a month, and double pay for working on Sundays. Of course, the bill of fare was much simpler; that didn't trouble us very much; we had a few staples and that was all we required. All contracts were very small, and I can remember when we were very glad to get them. I think one year there were thirty contracts and I suppose there were about 100 or more applications for those contracts. They set a minimum and a maximum rate and the thirty coming within those bounds were allotted the work. Of course the conditions now are very much different and I can understand the difficulty of getting men out in that country where so many public works are going on. I am sure that the present rates of contract are too low and I think it would be wise for the Government to undertake the question of raising them.

MR. HUBBELL: I think, Mr. Chairman, we ought to commence soon, perhaps we could put that motion and appoint the Committee before we adjourn.

MR. DENNIS: I would propose for the Committee, Mr. Heathcott, who represents Edmonton here, Mr. Teasdale, Mr. Hubbell and Mr. Dumais. They be appointed a Committee to take up this matter at once, and they might possibly get the contract rates raised this year; if they got it, it would be a fine thing for the contractors.

THE CHAIRMAN: Will someone move the resolution?

Resolution moved, seconded and carried.

Mr. McArthur: I think no official of the Department should act.

The Secretary: The reason I added Mr. Hubbell is because Mr. Hubbell knows a good deal about the cost of the surveys, and has been over a good many contracts, and he has heard a good many tales of woe, no doubt, about losing money on contracts; he would be therefore in a position, if he would act, to help this Committee considerably. I will add you also, Mr. McArthur, to this Committee.

Mr. Currie seconded motion.

Mr. Chairman: If there can be an adjustment of the rates brought about by the Association, it will be an honour to the Association. I am sure this resolution is in the right direction.

Resolution carried.

The Chairman: While we are together, gentlemen, you will all bear in mind the Annual Dinner to-night at the Chateau Laurier. We have a very large array of Canadian talent for to-night, some of the best orators of the land, and we trust you will all take advantage of this and come and give us your encouragement.

This afternoon, at three o'clock, we have an address on Boundary Surveys, by J. D. McArthur, Assistant Commissioner of Boundary Surveys; also an address by Dr. W. F. King, Chief Astronomer on Geodetic Surveys, both of which will be very interesting and we trust to have a large attendance.*

The meeting thereupon adjourned for luncheon.

* The addresses by Mr. McArthur and Dr. King could not be secured in time for insertion in this report.

SURVEYORS' ANNUAL DINNER.

The most successful dinner, from every point of view, in the history of the Dominion Land Surveyors' Association was held in he Chateau Laurier last night, when between sixty and seventy members and guests sat down, under the chairmanship of Mr. C. F. Aylsworth, Madoc, Ont. It was marked by the utmost geniality and some remarkably good oratory, the foremost artists being perhaps Dr. Deville, Surveyor-General, and Dr. Alfred Thompson, M.P. for the Yukon Territory.

Before the toast list opened, the chairman paid an eloquent tribute to Dr. Roche, Minister of the Interior, whose unfortunate illness alone prevented him from being present at the gathering. That circumstance was regretted by all surveyors, and, as was shown by subsequent speeches, by both political parties in the House.

Advice to Surveyors.

The first toast, "The Senate," was replied to by Senator Joseph P. B. Casgrain in his usual vivacious style. After referring to the proposed Hudson Bay Railway, and the work of Mr. G. P. B. Clergue in connection therewith, he urged upon surveyors the advisability of giving information to the government and the country on such and similar undertakings.

The "House of Commons" brought more than one legislator to his feet, and each of them hinted jocularly at the "shift" which loomed ahead of him, day or night, "in another place."

In proposing the toast, J. G. Turriff as member for Assiniboia, devoted part of his remarks to the great territory north of the Saskatchewan River.

Mr. E. B. Devlin, M.P. for Wright, remarked that surveyors were about the hardest worked class of men, and they did not get enough credit for it. They could not have built their great canals and railways without surveyors, who had done, perhaps more than any other body of men, their share in making Canada the brightest jewel in the British Crown.

Donald Sutherland, M.P., also replied, characterizing surveyors as the trail blazers of civilization.

The Sister Societies.

"The Sister Societies" brought an optimistic speech from Dr. Otto Klotz, the proposer, who remarked that all the societies were of one family. Mr. J. Dobie, President of the Ontario Surveyors'

Association, predicted that one day the great clay belt of Ontario would be well populated, and the West would be closely united to the East. Mr. E. F. Uniacke replied on behalf of the Ottawa branch of the Canadian Society of Civil Engineers, and Dr. Goodwin, of Queen's, Kingston, on behalf of the Mining Institute, whose sessions open today. He mentioned that an international congress of geologists was to be held in Toronto, next year, when about 1 000 geologists will be present from all over the world. The government and provincial governments were supporting the congress, which would be of the greatest importance to Canada.

A Bright Future.

The "Topographical Service of the Department of the Interior" was proposed by Mr. J. J. McArthur, and replied to by Dr. Deville. Dominion Land Surveyors, said Dr. Deville, had been put out of private business in the Western provinces by the legislatures. That was, perhaps, unfair, but they had to put up with it, for the provinces were within their rights, He was optimistic as to the future of surveying, for although much of the land north of the Saskatchewan River was swampy, it could readily be drained and settled.

Canada's Greatest Reserve.

Dr. A. Thompson, M.P. for Yukon, then delivered a picturesque address on his great constituency, in which he eulogised the work of surveyors. The Yukon Territory was no waste, for no less an authority than the late Dr. Dawson had declared that one day the Yukon would be Canada's greatest reserve.

ANNUAL MEETING OF THE ASSOCIATION OF DOMINION LAND SURVEYORS, 5TH MARCH, 1913.

MORNING SESSION.

The report on contract rates was read by Mr. E. M. Dennis.

MR. AYLSWORTH: Gentlemen, you have heard the report on the contract rates for contract surveys; what is your pleasure that we should do with it?

MR. HEATHCOTT: Mr. Chairman, I move that we adopt this report.

MR. MCARTHUR: I second that motion.

MR. AYLSWORTH: It has been moved and seconded that we adopt the report on contract surveys.—Motion carried.

DR. DEVILLE: I would like to make a few remarks. There is one argument of the Dominion Contractors that has been repeated time and again about the North and South outline. They have very often come to me from long distances to explain that it costs more to run the outline than the interior lines of a Township, and that the rate is insufficient to pay for the running of that line. That is quite true, but I would like to put a question. Suppose there are six miles of outline and forty-two miles in the interior of the township, forty-eight miles altogether. Now suppose that it costs $8.00 more to run that outline, will you not get the same total in dollars and cents if you spread that $8.00 throughout the whole of the township making it $1.00 per mile instead of putting it at $8.00 per mile for the outline alone? Will not that give you the same result in dollars and cents? Why then should you have two different rates whilst one will give you the same result? I have no authority to give an answer to this memorial, the Minister himself will tell you what he will do. Of course, I suppose that Dr. Roche will ask my advice and give a certain weight to what I represent to him. Now that you have heard one side of the question, it is well that you should hear the other. As regards aneroid barometers, I should not wish to see them discarded without further enquiry, for I think they may be useful if handled with care. As regards contract rates, what do you find? More than once, base line surveyors, who are fairly well paid as you know, have come to me and said, "I have served you for many years, always done my best, and you have been satisfied with my work, now let me have a chance of making money by giving me a contract." You would think from what you have heard that contracts were forced upon surveyors, and that they had to take them whatever the rate of pay was. What are the facts? The facts are that they are tumbling over each other to get these contracts. The salary that we pay to your worthy President for instance, is not good enough for them, they would not accept it. What are we to conclude from that? It seems to me the conclusion is that if an increase is to be made, it should be in the salary of your President, and of those who like him are employed at a stated salary. Is that not a logical conclusion? I must mention, however, that the office staff of the surveys is very much underpaid, and my first object just now is to try and secure adequate remuneration for their services. I do not mean that the claims of the fieldmen should be disregarded, but my first duty for the present is to obtain for the office staff what they ought to have and all my efforts are directed to that end.

Mr. Ransom: Mr. Chairman and gentlemen, I have not got much to say. I have been on contract work now for two years, and it is my own fault if I have not done well; but there are just a few remarks I would like to make. I do not think I ever wanted to get rid of the extra work of taking barometer readings, my only regrets in connection with this was that the money I was allowed would not permit me to go to the expense of taking barometer readings in the way I felt it should be done. Last year, I completely spoiled four barometers at $19.00 each, which came to $76.00. In taking barometer readings to do the work as I thought it should be done, I should have a barometer in camp as well as barometers on the line. But I found I had to have them repaired very often at much extra expense, and even then, because these barometers had to be carried by men doing other duties, they could not be looked after properly. It costs too much to send men out on the lines and get barometer readings and look after the instruments properly, in order to get proper readings. I could not afford to do that. Another thing regarding observations last year, I could not do much because the weather was not favourable, and it was very difficult to get a place to set up unless I got into some place along the bank of the river, and it was very hard to get the proper sky unless the trees were cleared away. Lots of my observations were left till this winter. It is only once in a while that one gets the favourable weather, and he would have to be away from his party perhaps four days to get that observation, and he might have to make one or two observations in townships, and even then perhaps he could not get the check he wanted. I had four college men with me in the summer, but in the winter I had none, so I could not leave my party because the men were not qualified to look after the work, and in that way there are several things such as barometer readings and observations I could not make, and it was a matter of regret to me as I felt I could not do what I wanted to do, and I think it is a very awkward position.

Mr. Heathcott: I should like to say with regard to the north and south boundaries, in our new rules which we submitted to the Association we have not tried to get paid for north and south boundaries; just the general outline rate being accepted in the manner the Surveyor General suggested. Then with regard to the asking for contracts by men who have been on base line work and wanted to make money, I could quite understand that five or six years ago, but I should like to ask the Surveyor General if many of them have recently asked him.

Dr. Deville: Yes, there has been one, Mr. Ponton.

Mr. Heathcott: I should reply to that by saying as Mr. Ponton has been working on base line work for a long time, he does not realize how low the contract rates are just now, but perhaps after this year he will not be anxious to get another contract if the rates are not raised. Perhaps the Surveyor General thinks we should discontinue going in for raising contract rates and salaries and do more to raise the profession and not bother about wages, but at the same time we are not all wealthy enough to work for the love of the thing. The first thing is to be in a position to do that before we commence it. With regard to the barometer readings, I should like to suggest something else to take their place, and I would suggest still further that there would be no reason for using barometer work if we ran a level on every line and allow for it in the rates.

Mr. Aylsworth: They say Surveyors are never orators because they are too logical, and a logical man cannot be an orator. I think the Surveyor General has delivered a very logical address here this morning, probably as logical an address as has ever been delivered. It has been so logical that it has been almost crushing, but I agree with him in all his points. I think that we should work for the up-building and standing of our Association in every possible way, and act like older Associations and not keep on fighting for increases of salary. I think, though the Surveyor General touched upon a sore spot when he mentioned that the only object we had was to do away with barometer readings. I do not think that was the object that animated us when I discussed this matter with the Secretary. Mr. St. Cyr is an authority and his results have proved that the barometer was very accurate, and we tried in every possible way to get an address from him in order to uphold its benefits. I recognize the value of barometers in all kinds of subdivision surveys to assist the outline of plan and obtain an exact contour of the surveyed area within that plan. Then again, when Mr. St. Cyr could not prepare this paper, we went to Mr. Dodge, who I do not think has any idea of doing away with the barometer, but he did not have time to prepare this paper. Now, gentlemen, this barometer reading question has touched me upon a sore spot, also the remarks of the Surveyor General, and I wish to vindicate the aspirations of the Association. I am not a contractor.

DR. DEVILLE: Some say the aneroids are too small. They are by Shortt & Mason, and they are the very best that are being made. It is true that they are smaller than the regular three inch surveying aneroid, but the difference is only in the case. The movement is the same as that of the three inch surveying aneroid, only we have cut out all the ornaments which merely added about $20.00 to the cost of the instrument and did not make it any better. If you cannot get good results with that aneroid, you will not get them with any other kind. We are trying to work out the result of the observations, but I do not know yet whether we shall be successful or not. This would be a very good subject for discussion if it is approached in the proper spirit, and not simply with the idea of getting rid of the work.

MR. ROBERTSON: If success is to be obtained with the aneroid, I think it is absolutely imperative that two should be used, one in camp, and the other on the line, being read at frequent intervals. In 1904 and 1905 I adopted this system, and the ground was afterwards gone over with levels and we got some very good results. I think the barometer in camp should be read every half hour, and the one on the line should be read at the same time, then a comparison made, and I think we should get good results.

MR. HAWKINS: I should like to say that I very much appreciate the address of Dr. Deville, and I think it is a matter of regret that all the members of this Association should not have heard it. So far as the barometer goes I was very much struck with one gentleman's remarks, that he had used up four in one year. I think it is hardly necessary to use up so many. I have been over a large tract of this country, and I have used only one since 1906. These instruments are delicate and unless they are used with very great care, they are certainly no use. My own practice has been to always carry them on my person when travelling, and I think that if we are going to have good results this should be done. On two occasions I met with surveyors while I was in the field, with defective barometers, and they had simply packed them away with other tools. It seems to me that you cannot expect anything else. I think that good results follow from the use of barometers as far as I have noticed it.

Of course, it is not as good as the level, but it always gives a fair indication, and I think they should not be abolished unless leveling were substituted on all contract surveys at the present time.

Mr. Ransom: I am very sorry I did not make myself quite clear just now. What I meant was that I could not send men out to carry them, and if a surveyor is in a rough country, he has occasionally to swim across small creeks and slip into the water very often, and though he has his barometer in his hat, still it will get wet. I have very often been on the line myself, and we got wet, and barometers and even watches got rusty, and very often we have left the things hanging on a tree and gone on with the work. It is very difficult to carry the instrument in such a case, and a man to read the barometer should be doing nothing else unless it is to take observations.

Mr. Taggart: During the past two years I have been working in British Columbia, and I think every one will agree that the country is rough. My chainman has carried my aneroid for two seasons with satisfaction, and I think the chainman can carry the barometer if it is packed with a little care.

Mr. Aylsworth: What is your experience with a barometer, Mr. Heathcott?

Mr. Heathcott: I have no experience.

Mr. Nelles: I think the instrument man could carry the barometer with him when he moves up to his next station, and make a short note of the barometer reading. The barometer reading is only approximate anyway, and the instrument man could make a note of say twenty chains or thirty chains as the case may be.

Mr. Ransom: It seems to me that there is a great disadvantage. Supposing you are out a mile and a half, the man would start out and perhaps the mileage that he had got the previous day would not be on the way to his work the following day. The chainman would have to walk a mile and a half to do the barometer reading, and in that way it is a disadvantage to have the chainman do it.

Mr. Taggart: I think it would be better to take the barometer readings in camp; if the readings were taken every morning in camp they could be corrected at any time.

Mr. Nelles: To get correct readings, I think it is absolutely necessary to have two barometers in camp. I have gone back in the afternoon to check them and found three hundred feet out, so that it is not much good unless you do something to check them.

Dr. Deville: The best plan is undoubtedly to take readings in camp, but we think that possibly this may be dispensed with by using the daily weather maps. The aneroid is used successfully elsewhere. It is nothing new and I do not see why Dominion Land Surveyors should not be able to do what others are doing. We do not expect to get levels within a foot or even ten feet, but we should like to get some idea of the configuration of the country, and I am sure that would be useful.

Mr. Nelles: I think that the weather maps give a fairly approximate idea of the barometer readings all over the country.

Mr. Dennis reads paper with regard to the rates paid surveyors.

Edmonton, Alta.,
25th February, 1913.

To the President,
Association of Dominion Land Surveyors,
Ottawa.

Sir:—

We would like to lay a few facts before the Association for its consideration in connection with contract surveys and the present rates allowed. Below are the names of two surveyors showing exactly what it cost them to complete the contracts in question, without salary to themselves:—

	Amount of Contract.	Cost of Contract.
1911, J. L. Cote.	$10,100.12	$10,284.89
1911, R. V. Heathcott................	9,512.00	10,544.47

These figures do not take into consideration interest on money withheld, which usually amounts to $2,000.00, and on $3,000.00 more which it is necessary to borrow to carry on the work until progress sketches can be turned in. At 8% this will amount to $400.00. These gentlemen are willing to vouch for the accuracy of these figures, and although most of the contracts show a profit, in the majority of cases it is very small.

Now, two questions naturally arise in connection with these statements, namely:—

1. What is the cause of these small margins of profit in connection with contract surveys of to-day, and

2. How it is that the Department received more applications for contracts than they are able to grant?

We think the best way to explain the first question is by making a comparison between the contractor of to-day and the contractor of five and ten years ago. This comparison will naturally fall under the following heads:—

(1) Location of contract.
(2) Wages and cost of living.
(3) Regulations and enforcement of same.

LOCATION OF CONTRACT.

Most of the contractors will agree with us when we say that the location of a contract is the largest factor we have to deal with when considering the profit to be derived from it. From the day a surveyor starts organizing his party, until he has actually run several miles of line, and has his party in working order, it is all a dead loss to him, and on the accessibility of his contract depends the amount of this dead loss. Five and ten years ago a great many of the contracts were in what is to-day the finest agricultural land in the west, and in many cases the most thickly populated. Even at that time a good deal of it was traversed by railroads and well travelled trails, and contractors met with little difficulty in moving from camp to camp. This was not only a large saving in time, but an entire party could be moved with a couple of small teams, while to-day, a contractor is forced to use fairly large horses for his wagons and supplement them with from 6 to 8 pack ponies.

A rough comparison of the cost of the horses might not be out of place at this point. Ten years ago, two suitable teams could be bought for $250.00 per team, or at a total cost of $500.00. To-day, these teams will cost $375.00 each or $750.00 for the two, while pack ponies cost from $75.00 to $85.00 each. Six of these would amount to $450.00 at the lower price, bringing the total cost for horses, to-day, up to $1,200.00 as against $500.00 formerly,—an increase in capital of 140% for this item alone. This also necessitates additional men and a larger camp equipage, while a good packer, to-day, commands a wage of from $75.00 a month up.

Most of the contracts, to-day, not considering those in the Peace River District, are situated six or seven days' travel from the railroad, and it takes these outfits another five days to come out after their work is complete, making twelve days in all. These parties usually consist of seventeen men, all told, and cost the surveyor an average of $3.00 per day per man, representing a total cost of $600.00.

Contractors in the Peace River District are at a much greater disadvantage in this respect. It took some of them, last year twenty days to reach their work and fifteen to return, making thirty-five days in all, while a contractor at Fort McMurray spent thirty-two days in the same way. A party in these districts usually consists of twenty men, and figuring the average of their wages, board and cost of horse-feed in those parts, we can safely say they cost the surveyor \$3.50 per man, per day. It can thus be seen that these men are paying between \$2,000.00 and \$2,500.00 for getting into their work and returning at the end of the season. Where the proceeds of the contract amounts to between \$15,000.00 and \$20,000.00, it means between 10% and 15% is used up in this manner.

There is one other point which might be mentioned here, and this is the nature of the country being subdivided. There is little doubt that the surveyor of to-day has many more natural obstacles to overcome in carrying on his work than formerly. The chief of these is opening up of wagon trails and finding places to camp, from which the work can be carried on. This becoming more difficult on account of the large muskegs met with further north.

WAGES AND COST OF LIVING.

To-day wages are much higher than several years ago. Ten years back, first class axemen could be obtained for \$30.00 per month. These axemen now can get \$3.00 to \$4.00 per day in British Columbia logging camps, and we are forced to hire unskilled immigrants at \$45.00 per month, and, on account of the large amount of railway construction, even they are difficult to get. Cooks and packers whom we used to pay \$50.00 per month, are now scarce at \$75.00 per month. We are required to pay assistants \$100.00 to \$150.00 a month, whom we could hire formerly at \$75.00. These men require a great deal better class of provisions than formerly. A glance at the accompanying list will show that the surveyor supplies as much variety and quality as many hotels. The increase in the cost of these supplies has, in the last few years, been very great. Statistics compiled three years ago, when the Civil Service wages were increased, showed that the cost of living was 40% higher than it was several years ago. Provisions were a larger item in this calculation, and this increased cost affects the surveyor more than anyone else, as where he is a married man he has his home as well as his camp to provide for. Owing to the methods of transportation he is forced to use, there is always a loss from accidents and weather conditions. Flour and sugar get wet, meat moulds, etc. The cost of provisions is also increased by the number of horses required, as mentioned above.

We might add here that surveyors working in the Peace River District have had great difficulty in keeping their men. Surveyors working in that part of British Columbia adjoining this district, pay axemen from $60.00 to $75.00 per month, and, of course, it is natural that a man will go where he will get the best wages.

REGULATIONS AND ENFORCEMENT OF SAME.

From year to year the duties of the surveyor are being added to.

First of all, attention should be drawn to the matter of re-cutting the North and South Boundaries of Townships.

If, in running across the North or South Boundary of a Township, the Surveyor strikes the township corner with his trial line, he is unusually fortunate, especially if he turns his angle from an outline run by another man. In practically all cases this line has to be re-run.

Cutting the trial line is generally an awkward proposition owing to the difficulty of keeping camp within walking distance. Then when the line has to be re-run, it is necessary to send back a fly camp and this holds up the whole outfit, making this line even more expensive to run than others of the survey.

As this is a very important line, it should be surveyed very carefully. We would particularly draw your attention to this extra difficulty and to the fact that this line, which we are required to re-survey for nothing, amounts to 12% of the total work in the township.

Again, we are required to place iron posts at quarter-section corners. The freight on these is heavy and placing the posts necessitates extra work on the line. As an example of the freight rates, we might quote Mr. Tremblay, who had to pay eight cents per lb. last fall on freight from Edmonton to Fort McMurray. Each post weighs 2½ lbs., making the freight for each post twenty cents in this instance.

Blazing requires the attention practically of one man on the line, and is an item which was not formerly enforced.

Lately we have been required to take barometer readings, and this, as well as being an additional duty, entails considerable expense for the cost of barometers and their repair. We are of the opinion that the information obtained by barometer readings is far from accurate, and in fact very misleading.

Another addition to our duties is keeping a diary. Whilst it is a small matter to make entries asked for, it is extra work required at a time when a surveyor has many other matters on hand, such as working down observations, planning for future work, and attending to the numerous details in connection with his camp. It should also be remembered that all these things have to be attended to after a hard day's work, and amid all the discomforts of camp life.

The inspection of surveys is very rigid now. For example, Clause 316 of the Manual states that the field notes must show every opening of half a chain or more where no cutting is necessary. The chainers are very liable to pass such small openings, or their opinion may not be the same as that of the inspector in regard to whether there is an opening or not, and the matter may not be drawn to the attention of the surveyor. Therefore, we would ask for latitude in this connection.

Regarding the second question, there are several reasons for the number of applications which the Department received for contracts. Chief of these is that the surveyors must work, even when the profit is doubtful. In the last few years a large number of young men have served their apprenticeship and taken the examinations necessary to qualify for a Dominion Land Surveyor, and now that they have qualified they have to follow it up and try to make a living out of it. Undoubtedly, a good many of them have been tempted to do it on account of the larger contracts awarded up to within the last two years, but since the tendency seems to be to reduce the size of these contracts, the Department will probably find that the number of applications will be smaller. We think these reasons will sufficiently answer this question.

In view of the above facts, from which we can easily show that the actual cost of work, due to increased cost of living and additional regulations, has increased between 30% and 40%, we feel justified in asking for a substantial increase in the rates paid for contract surveys. We would ask the Association to strongly endorse this petition and, if possible, have the necessary increases included in the supplementary estimates for this year, and applied to this year's contracts.

Signed on behalf of the Dominion Land Surveyors of Edmonton.

(Signed)

J. L. COTE.
HARRY S. DAY.
J. A. BUCHANAN.
A. E. GLOVER.
AUSTIN L. CUMMING.
H. E. PEARSON.
R. H. KNIGHT.
A. DRISCOLL.
T. A. DAVIES.
G. W. MACLEOD.
A. W. PONTON.
WM. H. WADDELL.
J. H. JOHNSTON.
R. W. CAUTLEY.
R. H. CAUTLEY.
D. F. MCEWEN.
P. N. JOHNSON.
L. C. CHARLESWORTH.
A. P. C. BELYEA.
HOMER P. KEITH.
JAS. HERBERT SMITH.
R. V. HEATHCOTT.
GEO. A. TIPPER.
B. F. MITCHELL.

VICTORIA, B.C., 24TH FEB., 1913.

E. M. DENNIS, ESQ.,
Secretary, D. L. S. Association:—

DEAR SIR:—

In reply to your circular letter announcing a list of subjects to be discussed at the Annual Meeting next month, I beg to submit the following observations as to the rate of pay of surveyors employed in the Railway Belt in British Columbia.

British Columbia Land Surveyors, when employed by the Government, receive $15.00 per day, and furnish their own instruments and stationery, except printed forms. They send certified accounts to the Department and are paid the actual cost of running the party. I understand that it seldom costs less than one dollar per day per man. As against this Dominion Land Surveyors employed on work in the Railway Belt in British Columbia, receive $8.00 per day and are obliged to feed the party on an allowance of 60 cents per day per man, or make good the difference out of their own accounts. It seems unfair to expect Dominion Land Surveyors to work under similar conditions in the same country as Provincial Land Surveyors, for less remuneration.

Not only do Dominion Land Surveyors in the Railway Belt receive less than British Columbia Land Surveyors, but they receive less than other Dominion Land Surveyors, and have to work harder for it. They receive less because provisions are more expensive in British Columbia than in the prairie provinces, so that instead of having a balance from the allowances, as is usually the case in the prairie provinces, they often have to make up a deficit out of their salaries. The work is more difficult on account of the mountainous nature of the country.

It seems to me that it would only be fair to Dominion Land Surveyors working in the Railway Belt to place them on the same standing as base line surveyors, so far as remuneration is concerned.

Yours truly,
E. L. BURGESS.

MR. TAGGART: Mr. Chairman and Gentlemen, I wish to make a few remarks with regard to this letter. I certainly agree with Mr. Burgess. I have been working in British Columbia for two years, and I have no great kick on the rates I have been receiving, but I wish to cite a few comparisons. During the past season a provincial land surveyor was working in the valley and I was crossing over the mountains doing the dirty work. He was getting his $15.00 a day, and I was getting my $8.00 and my allowances. As to the allowances, I might say that one cannot make very much out of them. I think my allowances last year gave me a net profit of $80.00 to $100.00. But to do this one has to do some very hard bantering, and must be so situated that he can get all his supplies from one firm. This is figured using the total allowances for rations, and camp equipage as provided by the Manual, *i. e.*, 65 cents per day, per man, 90 cents per day for assistants, and $2.35 per day, personal. This is only a comparison between Dominion and Provincial Land Surveyors. As the wages of labourers have increased, the wages of Surveyors have not. The degree of accuracy required by a British Columbia Land Surveyor is not of such a high standard as is required of the Dominion Land Surveyor. Of course, it is much more satisfactory to do accurate work. I just wanted to make the point in order to compare the rates the Provincial Land Surveyors are receiving in British Columbia with the rates of the Dominion Land Surveyors.

MR. NELLES: I have been told that it is very hard to get good axemen. A friend of mine said that he had gradually collected around him a number of first class axemen, and in order to keep them he pays them $3.00 a day and keeps them all the year round.

MR. TAGGART: In British Columbia you have got to give them everything they require or they will not stay.

MR. NELLES: I do not see how you can feed men on 65 cents a day. It costs us for provisions alone, not to mention transportation, 70 cents a day, to be accurate 69.999c. per day.

MR. TAGGART: I think the total I had last year was something like $79.00, but that did not include camp equipment. It was just the ration allowance, and I gave them everything that it was possible to give them. I might say that I was about $150.00 out in my allowances in 1911, but that was accounted for to some extent by the extra amount of hotel expenses. My work was scattered from Golden to Ashcroft, and I had to put the whole party up in the hotel, but even with the ration allowance, one would not be anywhere near the British Columbia Land Surveyor, receiving $15.00. On an average a surveyor could not be expected to break even on the present allowances.

MR. FAWCETT: On the International Boundary, it cost us for provisions, 75 cents a day. Of course the men had everything in the shape of provisions, and they get it even better in the lumber camps. I had to pay them forty-five dollars a month in order to keep them.

Mr. Ransom: With regard to these prices, I bought my supplies in the spring at Winnipeg, from Campbell Brothers, and I got my sugar at $5.20 a hundred-weight, and flour at $3.05 a hundred-weight. Flour is the basis of everything. I got beef at 10 cents. a pound, and loose meat at 5½ cents a pound, and potatoes at $1.10 a bushel. The flour goes between $6.00 and $8.00 a cwt. I do not know what it costs to feed the men, but I know I had to feed them well.

Mr. Taggart: I may say that the lumber camps figure that it costs $1.00 a day to feed the men, of course they buy their stuff wholesale.

Mr. Ransom: It is easier to feed men in a dry country than in a wet. 15 or 20% of my supplies were spoiled by water this year.

Mr. Ayslworth: I think we have threshed this subject out pretty well from all directions, and we have derived much benefit from it.

We wish to know something about the conditions regarding the labour question. This is a very important question, and we have our difficulties in this respect, and when you come to engage a man for eight months in the year, it does not seem to be so hard to get him as it does to get labour in the harvest time; then everybody is after men, and we cannot get them for even three or four dollars a day, but in the spring things are different.

Dr. Deville: They are not paid for Sundays or holidays.

Mr. Hubbell: They are only paid for working days. When they are laid off they are obliged to buy their own rations from their employers, and have to subscribe so much per month towards a Doctor's fund. These men are paid various rates at different seasons of the year. Averaging $35.00 to $40.00 per month, in the Summer, which is reduced to $25.00 or $30.00 per month during the Winter. Specialists command better wages. Some men will not stay at one place for any length of time, and when offered a dollar a month more will leave. Our system of employing men under contract. I consider good, if you can make them keep to it, but under any circumstances, they will leave when they make up their mind to do so. On the question of labour, I think that the rates we are paying to-day for labourers on survey parties, is not far from right. There are exceptional cases when it is almost impossible to obtain any kind of help, especially during harvest time. The price of provisions varies but little in the different places in the West, and general supplies, such as flour and bacon are pretty much the same all over. The fat pork that we used in the early days was a very suitable article, but if you ask men to eat this to-day, they will not do so, but throw it away. They now demand breakfast bacon, butter, cheese, white sugar, potatoes, etc., and butter is 35 cents a pound, but there has been occasions when I got it for 15 cents, and I have paid as high as $13.00 a cwt. for white sugar.

In my estimation the labourers on the whole, are sufficiently paid, but the ration allowance is inadequate.

As regards the wages of cooks on survey parties, it is a very important matter and serious question.

Mr. Aylsworth: A burning one (laughter).

Mr. Hubbell: The success of a survey camp practically depends upon the cook. He can either make or break the party, and a surveyor who has a good camp cook is lucky indeed. I think we should ask the Surveyor General for an increase of pay for the cook. This is an important matter, and worthy of consideration. The Surveyor General himself knows, and we all know, how the matter affects us. I think that the ration allowance of 55c. per man is not sufficient; it should be raised to about 75c. per man.

Mr. Taggart: In British Columbia the labourers wages have been increased, whilst the Dominion Land Surveyor's pay remains the same. Why should a Dominion Land Surveyor receive less than a British Columbia Land Surveyor? The men could get $3.00 a day in the lumber camps and pay their own board and doctor's bills and other incidentals. At present their wages would be about $55.00 a month, whilst the Dominion Land Survey man gets his $60.00 a month. As regards the cooks, we had to increase their wages as it was almost impossible to get a man to stay, but this year we had no trouble whatever, but we could not get a good cook for less than $75.00 a month.

Dr. Deville: We are very glad to hear about these things. We only know what the surveyors tell us. What would be a fair salary for a cook, east of the mountains for instance? That is an important matter for consideration.

Mr. Fawcett: We have to pay $75.00 for a cook for a small party.

Mr. Ransom: I have paid $75.00 all this summer to one of the best cooks in the West, but he could leave and get $125.00 from Mr. Finger, but he is a man who likes survey work, and he stayed with us for $75.00.

Mr. Hawkins: This cook question, Mr. Chairman, has always been a very burning question. I had a fair cook and I paid him what was allowed, but I increased his salary out of my own pocket, and I think it paid me to do that. Last year I tried another experiment with a man I had had for several years. I put him in as cook and he did very well on the allowances. He was only paid the allowance made by the Department, but as a general rule I do not think we paid him enough. I know it is true that a good cook in the Edmonton District can get into a permanent camp and get his $120.00 a month, and I shall be very much pleased to see a better allowance made.

Mr. Taggart: I would like to mention another point now, with regard to the hiring of men of a survey party. From experience, I have found that it is some times best to give a man, such as a picket man, who is sometimes a very competent man, a special wage or a little higher than the others. Such a man is much more valuable than an ordinary labourer. For instance, during the past two years, I have had a man who has been on survey work for eleven years, and he still gets the same money. He is competent to do any kind of work, but instrument work. I have remunerated that man out of my own pocket. I was wondering whether it would not be possible for a regulation to be made by which one could give such a man, say $5.00 a month more.

Dr. Deville: It is not the intention to fix the wages of every man at a stated figure. Suppose an average was struck, leaving the surveyor himself to fix the wages of each man as he likes, how would that answer?

Mr. Taggart: That would not answer in British Columbia.

Dr. Deville: What I understand is that the average should be raised.

Mr. Taggart: That would help us out, say 25c. a day more.

Mr. Aylsworth: Gentlemen, I would be afraid of an inovation like that. I have been practicing now for seventeen years, and I have never done anything like that, and I would not like to. As soon as it gets out, as it would be sure to, you would have troubleous times. I say pay all men alike, and you will sleep better and work better.

Mr. Ransom: I quite agree with you there. I think it would mean a general strike all around. The only thing is to give them more pay for doing more work, but very often that would not answer.

Mr. Hubbell: If you engage a man, say for eight or nine months at $40.00 a month, and tell him that at the end of the season, if he remains with you and does good work, you will pay him $45.00 a month for the whole time, it is up to him to stop and get the bonus. He will think twice before leaving if he knows that in a month or two longer he will get $45.00 instead of $40.00 for the whole season.

Mr. Aylsworth: Well it is a good idea for one year, but if you pay one man more than another, he will tell his girl and she will tell somebody else, and they will all be after an increase of pay.

Mr. Taggart: I cannot get a man to sign an agreement.

Mr. Aylsworth: All my men sign agreements.

Mr. McArthur: My experience is that it is better not to have an agreement with some men.

Mr. Aylsworth: Well, Gentlemen, I think we have discussed this question from every point of view. I think that as regards the cook question, the Surveyor General understands our troubles. If the cook is not satisfactory the party is blue, and the cook can make everything blue and the report will be blue. He is the man that runs the whole party. I have had a cook for the last three years. He has got now that he runs me, so I am looking for another cook, but I have not found one yet. I hope the Surveyor General will take the cook question into consideration.

Now, Gentlemen, the next in order is the election of officers. I hope we will do this with great care. The first officer to be elected is a patron.

Mr. Hubbell: Article 4 of the Constitution sates that the Surveyor General shall be patron of the Association.

Mr. Aylsworth: Then the next is the Honourary President. He is standing also. Mr. J. N. Wallace has put the name of Mr. J. S. Dennis in nomination as Honorary Member.

Mr. Hubbell: I think that Mr. Dennis is a gentleman and surveyor whom our Association has every reason to be proud of. He was connected with the Association in its early days, and by his advice and personal interest encouraged the members to band together and do all in their power to elevate the standard of the profession, and I have every reason to believe that Mr. Dennis has not forgotten his old love, but will at all times do his utmost to assist a brother surveyor. I take great pleasure in seconding Mr. Wallace's nomination.

Mr. McArthur: I think Mr. Dennis is a very good man.

Mr. Aylsworth: It has been moved and seconded that Mr. J. S. Dennis be an Honorary Member.—Carried.

Mr. Aylsworth: It seems to me that the West is the area in which we will do most of our work, and perhaps another Honorary Member would not be out of place in that vast area, and I would suggest the names of Mr. Charles McGrath and Mr. Casgrain.

Mr. Hubbell: They are both now Honorary Members.

Mr. Aylsworth: The next office on the programme is that of President. Let us get to work as time is fleeting.

Mr. McArthur: I propose that Mr. Miles be elected President.

Mr. Fawcett: I have much pleasure in seconding Mr. McArthur's motion. Mr. Miles was the Vice-President last year, so I take great pleasure in seconding Mr. McArthur's motion that Mr. Miles be elected President.

Mr. Hubbell: I remember last year, we had some difficulty in getting Mr. Belanger to accept the presidency, but we prevailed upon him to do so, and I am sorry he has considered it necessary to resign. When we proposed Mr. Miles last year for Vice-President, he did not want to accept, but I think that if we elect now a good active Vice-President, Mr. Miles will accept the position as President. He will not want any hard duty as he has been in the field for ten months, and is hardly out of it yet. I agree with Mr. McArthur that it would be advisable if we can get Mr. Miles to accept the position as President.

Mr. Aylsworth: Mr. Miles has been nominated as President of our Association for the coming year, and the motion has been seconded.—Motion carried.

Mr. Aylsworth: The next office is the position of Vice-President.

Mr. Hubbell: I propose that Mr. Alysworth be elected Vice-President.—Carried unanimously.

Mr. Aylsworth: I thank you gentlemen.

The next officers on the list are the Second Vice-Presidents for the different provinces of the Dominion. Should we nominate them here or send out ballots and have each province elect its own choice?

Mr. Dennis: The resolution did not specify just how the nominations should be made. I think possibly we could appoint a Committee to define how the nominations should be made and election carried on, or else we could do it here this morning.

Mr. Ransom: It will be difficult to get the members and the Dominion Land Survey men together at a given nomination.

Mr. Aylsworth: I think it better to send out a ballot to each member and ask who is his choice and whoever gets the majority will be elected. I think these ballots should be sent out to every member of the Association living in each of the provinces.

Some Members: Yes.

Mr. Aylsworth: Well then, I think that will be satisfactory and will give everyone an opportunity of having a voice in the proceedings of this Association. I think it is a good idea for one year anyway.—Carried.

Mr. Aylsworth: The next item on the programme is the appointment of the Executive Committee of three members. Mr. Nash has intimated to me that he wished to be excused this year, and I would suggest a good strong Executive Committee. I think they should be members of the Association residing in the city. There are three required, the names last year were I. J. Steele, J. D. Craig, and T. S. Nash.

Mr. McArthur: I propose Mr. Nelles, Mr. Robertson and Mr. Henderson.

Mr. Fawcett: I second that.—Carried.

Mr. Aylsworth: The next position is that of Secretary-Treasurer.

Mr. Fawcett: I think we have a very good one in Mr. Dennis, and I move that Mr. Dennis be re-appointed.

Mr. Dennis: I thank you Mr. Fawcett, for nominating me, but I wish to resign this year as the work is rather more than I can undertake. If you will withdraw your nomination I have another to make. Mr. Chairman, I wish to nominate Mr. Hubbell for the position of Secretary-Treasurer. He has an office in the Department now, and an assistant, and all the paraphernalia for doing the work, and I accordingly propose Mr. Hubbell.

Mr. Aylsworth: I think as Mr. Hubbell has just "beat it" as they say in the West, we may take it he is willing to accept the position. I think that Mr. Dennis has made a very good selection. Mr. Hubbell has all the paraphernalia for doing the work well.

Mr. Fawcett: I think there is no one better qualified than Mr. Hubbell.

Mr. Aylsworth: Well, I understand that Mr. Dennis has resigned and that Mr. Hubbell's nomination is carried.—Motion carried.

Mr. Aylsworth: Well, Gentlemen, we have a few moments yet. A great many of our old members are dropping by the wayside, and there is no method of collecting data with reference to their careers. If I understand it correctly, they have such a system in the Ontario Lands Association. We are all interested in reading the careers of our distinguished members who have passed away, and it would be a good idea for us to begin such a Department, and my idea is to appoint such a Committee of old members who have been associated and whose families perhaps know one another, and I think in that way we could get a very good history of our old professional brethren.

Mr. Fawcett: I think the officer in the Surveyor General's office has access to the returns and is in close touch with everything that would be important, and I think he will be the best man for such a position.

Mr. Dennis: Mr. Henderson is now the Secretary of the Board.

Mr. Fawcett: I suggest Mr. Shanks.

Mr. Robertson: I think we ought to say something in connection with the work done by our late Secretary-Treasurer. I do not think the small amount he received recompensed him for the large amount of work he did.

Mr. McArthur: I think the Secretary has shown great energy and I am sure he has not spared himself in any way.

Mr. Dennis: Gentlemen, I thank you very much for your kind words. Last year I received and replied to about four hundred letters, and we published four hundred and fifty reports. I have got seven or eight new members since the meeting commenced yesterday. I thank you very much for your kind expressions.

Mr. Chairman and gentlemen, allow me to nominate Dr. King and Mr. Henderson, as well as Mr. Shanks on this Committee. Mr. Henderson, being the Secretary of the Board, is in a position to know what is required, and Dr. King knows most of the older members. Now I think these gentlemen would form a good Committee.

Mr. Fawcett: I think we could not possibly get a better Committee for compiling biographies than those mentioned.—Carried.

Reports and Publications Committee: Messrs. Nelles, Taggart, and Reid were appointed.

Mr. Aylsworth: The only trouble is that it has been the practice in the past not to practice at all until the next meeting.

Practically nobody did anything except the Secretary-Treasurer. Now if you leave everything to the Executive Committee they will do it at the next meeting perhaps. We might as well have a full understanding and I think it is the practice with the Ontario Lands Association to appoint a Committee like this.

Mr. McArthur: I think it is sufficient to lay the matter in the hands of the present Committee.

Mr. Aylsworth: This closes the business for this morning. This afternoon we have an address by Mr. Hubbell, Chief Inspector of Surveys, at three p.m. I trust all of you will come and hear Mr. Hubbell's address, which promises to be interesting as well as instructive. Permit me to announce to you that an address on Forestry, by Mr. R. H. Campbell will be delivered this evening at 8 p.m. We all know the importance of forestry. It is a vital subject and I hope that as surveyors all will take an interest in this subject, for it is a subject of importance to all Canadians. Ladies are invited.

AFTERNOON SESSION.

Mr. Aylsworth: The principal item for this afternoon is an address by Mr. Hubbell, D.L.S., Chief Inspector of Surveys, on "Inspection of Surveys."

PROGRESS AND INSPECTION OF SURVEYS.

E. W. Hubbell, D.L.S., Chief Inspector of Surveys.

Mr. Chairman and Gentlemen:—

I have been honoured with a request to explain my views on "Inspection of Surveys," as conducted by our Inspectors, when inspecting survey contracts in the Western Provinces.

Before attempting this, I ask the indulgence of those present to permit me to give a brief outline of the progress of our surveys in the West, in conjunction with a few subjects which I think should be of interest to all Dominion Land Surveyors.

The Department of the Interior was established July 1st, 1873, the first Minister being the Hon. Alexander Campbell, who had under his control the following branches of the service:—

1. The Affairs of the N. W. Territories.
2. The Lands and Affairs of the Indians of Canada.

3. The Ordnance and Admiralty Lands and all other Public Lands, not under the control of the Department of Public Works, or of those of Militia and Defence, and Marine and Fisheries.

4. The Crown Lands in Manitoba and the N. W. Territories, styled "Dominion Lands."

5. The Geological Survey of Canada.

Prior to the first of July, 1873, the management of the N. W. Territories and the Lands and Affairs of the Indians, devolved upon the Department of the Secretary of State for the Provinces, to which Department the Geological Survey was attached, On the other hand, the Dominion Lands and the Ordnance and Admiralty were under the control of the Secretary of State for Canada.

In July, 1869, instructions were issued by the Minister of Public Works to Lt.-Col. Dennis, P. L. Surveyor, requesting him to suggest a scheme or system upon which to base the Surveys of the West. This was done and approved, and the survey of the Principal Meridian by Milner Hart and A. C. Webb was the first survey performed under authority of the Dominion Government, in the Territories. At this time the outbreak known as the Red River troubles occurred, and put an end to further surveys for the time being.

In 1870, no surveys were undertaken.

In March, 1871, Col. Dennis was appointed the first Surveyor General of Dominion Lands, and during the same month the administration of the Dominion Lands was transferred to the Department of the Secretary of State, and the Dominion Lands Branch was created. The first Manual of Surveys for the guidance of surveyors was issued in this year, and instructions were given to twenty-one surveyors, Mr. Lindsay Russell being appointed Inspector of Surveys.

In 1872, Captain Cameron, R.A., British Commissioner, was appointed in conjunction with the Hon. Archibald Campbell, named by the United States Government, to determine in accordance with the Second Article of the Convention of London of the 20th October, 1818, the International Boundary Line between Canada and the United States, from the North West point of the Lake of the Woods, due South to the 49th parallel of Latitude, thence Westward to the Rocky Mountains, Along the South of the Province of Manitoba, iron pillars were placed at two mile intervals, West of the Province the line was indicated by Cairns, generally three miles apart.

In this year instructions were issued to Mr. W. S. Gore, P.L.S., to survey certain reserves granted to the Hudson Bay Company.

The first map to show the results of the surveys of Dominion Lands was issued this year with the Surveyor General's report, also the first official map of the Province of Manitoba.

In 1871-72, all surveys were performed by contract, at so much per mile, but in 1873 all the surveysors except those employed in subdivision, were paid by the day.

During this year (1871), 3,800 miles were surveyed and surveyors were paid as follows, all under contract:—

	Prairie.	Poplar Woods.	Heavy Timber, Windfalls, etc.
Block Surveys........	$9.00	$15.00	$25.00 per mile.
Subdivision Surveys ..	$7.00	$11.00	$18.00 per mile.

In April, 1872, an Act was passed called the Dominion Lands Act, in which the manner of administrating the lands in Manitoba and the N. W. Territories was dealt with and the system of survey explained. The Act also provided for a Board of Examiners, who were to examine candidates for admission to practice as Deputy Surveyors, and provided for the admission to practice of surveyors from the different provinces.

In May, 1873, the Bill creating the Department of the Interior was assented to, and on the 30th June the management and control of Dominion Lands was transferred from the Department of Secretary of State to the Department of the Interior. The Geological Survey was also attached to the Department, as was the administration of Indian Affairs.

It might be of interest to note here two important Acts passed by Parliament. 1st, in 1873 an Act authorizing the establishment of a mounted police force in the Territories. We all know the incalculable value this magnificent field force (since its inception) has rendered our great country, and whose jurisdiction now extends to Hershel Island in the Arctic Circle. 2nd, in 1874 an Act prohibiting the importation into and manufacture in the N. W. Territories of all intoxicating liquors. This Act was rescinded in 1891.

In this year (1873), the first surveys of Indian Reserves were undertaken, six surveyors being employed for that purpose, and on the 28th February, 1874, an Order-in-Council was passed authorizing a special survey of bases and meridians through the N. W. Territories, and extending to the Peace River. This important survey was placed under the control of Mr. Lindsay Russell, Asst. Surveyor General, and carried on for some years, one of the assistants being Mr. W. F. King, D.T.S.

It may be of interest to know that from 1871 to 1876, the cost of block outlines averaged $36.83 per mile. The cost of subdividing blocks of four townships into sections and quarter sections was 2.91 cents per acre, adding the cost of the block lines to the above acreage rates made the total cost of all the Township lands surveyed to date (1876), to be 3.83 cents per acre.

In 1877, the Geological Survey became a Branch of the Interior Department and the Museum was moved from Montreal to Ottawa.

In 1878, the charge of the N. W. M. P. was transferred from the Department of Secretary of State to the Interior Department. In this year, Col. Dennis was made Deputy Minister of the Interior and Mr. Lindsay Russell became Surveyor General.

In 1879, a new Branch was erected and added to the Department, called the School Lands Branch.

In 1880, the Indian Branch was created a separate Department and assumed control of the Indian Reserves in Manitoba and the North West Territories which had been carried on by the Surveyor General.

The Surveys of this year have consisted of two classes, outline, or governing ones, performed under the system of daily pay and allowance of actual expenditure incurred, and the subdivision surveys under contract, at rates of so much per mile for certain kinds of work; the rates of the latter having been fixed by competitive tender.

In 1881, 55 surveyors were engaged, 6,400 miles of meridian and outlines were run, and 16,800 miles of subdivisions.
Road allowances were reduced from 1.50 chains in width to one chain, and three of the East and West road allowances in a Township done away with.

A new edition of the Manual of Survey was issued containing many improvements and much information to Surveyors, as well as several useful tables prepared by Messrs. Deville and King, who were in this year appointed Inspectors of Surveys, succeeding Messrs. A. H. Whitcher and Milner Hart.

In 1882, Mr. Deville was appointed Chief Inspector of Surveys and took charge of the Surveys Branch of the Department, and Mr. Lindsay Russell became Deputy Minister of the Interior.

An important change this year was the substitution of iron posts for wooden ones at the section corners, the markings for each corner were stamped on a square tin about six inches square, placed over the bar and fastened to it by a nail.

In order to prepare the number of copies of township plans required, it was found necessary to establish a lithographic office in connection with this branch. Plans were printed by a cheap process, and although not presenting the appearance of good lithography from engraved stones, they met all requirements.

On the 8th of May an Order-in-Council was passed dividing the North West Territories into four provincial districts, called respectively Assiniboia, Saskatchewan, Alberta and Athabasca.

In 1883, 119 surveyors were employed. The extensive operations (the greatest on record) during this year and the previous season became necessary owing to the rapid construction of the Canadian Pacific Railway, which in the fall of this year, reached the Rocky Mountains. During the season surveying operations were conducted on a gigantic scale, over 70,000 miles were surveyed, providing 27,000,000 acres of land for the agriculturist.

Owing to the rapid growth of work in the Department, the offices of Deputy Minister and Surveyor General, held by Mr. Lindsay Russell, were separated. Mr. Russell remained Surveyor General, and Mr. A. M. Burgess became Deputy Minister of the Interior. The supervision of the surveys at head quarters was under the control of Mr. Deville, Chief Inspector of Surveys, while Mr. King, Inspector of Surveys, had the direction of the operations in the field, and a third edition of the Manual of Surveys was issued.

In this year we have our first information regarding the examination of Survey Contracts.

In 1884 the Settlement Act was passed by the British Columbia Government, and the transfer under its provisions to the Dominion Government of a belt of land 20 miles in depth on both sides of the Canadian Pacific Railway was effected, and surveys within this belt were commenced, also the survey of old trails in the Territories.

In June, Mr. Lindsay Russell, Surveyor General, retired from the service on account of ill-health.

In 1885, owing to the Riel Rebellion, surveys were limited. Mr. William Ogilvie was engaged in making a survey of the Railway line in British Columbia, to be used as a base for the future subdivision of surveys at points along the line. In March, Mr. Deville, then Chief Inspector of Surveys was appointed Surveyor General, which position he is faithfully, conscientiously and intelligently occupying to this day, Mr. W. F. King was promoted to Chief Inspector of Surveys.

In 1889, iron posts of a larger diameter were substituted at section corners, and the markings cut on the bars with cold chisels, a vast improvement on the original method of marking.

In 1890, Mr. King became Chief Astronomer of the Department, and in May, 1893, Mr. J. S. Dennis became Chief Inspector of Surveys.

In 1891, the Immigration Department was transferred from the Department of Agriculture to the Department of the Interior.

In 1892, Mr. W. F. King, D.T.S. was appointed International Boundary Commissioner, and in February of the same year, the Board of Examiners for Dominion Land Surveyors at Ottawa, passed the following resolution:—

"That this Board, after due consideration, have come to the opinion that examinations for Provincial Land Surveyors in Ontario and Manitoba are not sufficiently similar to those prescribed by the Dominion Lands Act, for Dominion Land Surveyors to entitle Provincial Land Surveyors of those Provinces to the privileges of Clause 109, and the Board is further of the opinion that it is desirable in the interests of a uniform standard, that no candidate should be granted a commission as Dominion Land Surveyor unless he has passed the full examination prescribed by the Dominion Lands Act."

"Surveyors of the Province of Ontario and Quebec are accordingly required to fulfil now the same conditions as surveyors of Dominion Lands, instead of as formerly, being admitted after examination in the system of survey only."

It may be of interest to note here, that all Western Provinces now have separate Surveyors Associations, and in order to obtain a commission to practice as a Surveyor in any of the Provinces, it is necessary for a Dominion Land Surveyor to pass an examination in conformity with the laws of each Province.

Time does not permit me to touch upon the following very important Surveys which have been administered by the Department of the Interior:—

The Triangulation survey in British Columbia, commenced in 1889, under the superintendence of Mr. W. H. Drewry, D.L.S.

The Photo-surveying in British Columbia, commenced in 1886, under the superintendence of Mr. J. J. McArthur, D.L.S.

International Boundary Survey of the 141st Meridian, under the superintendence of Mr. W. F. King, D.T.S., Boundary Commissioner, commenced in 1906.

The Irrigation Survey in Alberta, under the superintendence of Mr. S. J. Dennis, D.T.S., then Chief Inspector of Surveys, commenced in 1894.

The perusal of the reports on the above mentioned surveys are most instructive and interesting, and can be readily found in the annual reports of the Department.

In 1901, Mr. Wm. Pearce was appointed Chief Inspector of Surveys, and upon request was superannuated in 1904.

In 1901 the office of the Surveyor General was moved from its quarters on Wellington Street, to its present location on Metcalfe Street, but owing to the growing increase of the staff in recent years, it was necessary to move part of the staff to the Imperial Building on Queen Street.

The present numerical strength of the Surveyor General's staff is about 140, which is an indication of the clerical work performed by this important Branch of the Department.

NOTES.

In the first annual report of the Department of the Interior, published in 1874, reference is made to our President, Mr. C. F. Miles, as follows:—

"The lands reserved to the Hudson's Bay Company under the Deed of Surrender, at their several posts in the Lac-la-Pluce District, were also surveyed by Mr. D. L. S. Miles, during last season," forty years ago. He is still hale and hearty, and remained in the field continuously last season for ten months inspecting survey contracts.

EXTRACT FROM THE SURVEYOR GENERAL'S REPORT OF 1903.

"It is provided by the Dominion Lands Act that the township subdivision surveys of Dominion lands shall be performed under contract at a certain rate per township, per mile or per acre fixed, from time to time, by the Governor in Council or by competitive tender, as the Governor in Council from time to time directs. The rates fixed under the provisions of this clause, at the inception of the surveys of Dominion Lands more than 30 years ago, were, per mile of line surveyed, $7.00 for bare prairie, $18.00 for solid woods, and $11.00 for woods alternating with prairie. These rates remained in force until 1901, although the cost of labour and supplies had advanced considerably. In May, 1901, the rates were increased to $7.00, $13.00 and $21.00 respectively, but the cost of labour and supplies having continued to advance, the increase proved inadequate. The situation was aggravated by a succession of wet seasons, which made survey operations slow and costly. Survey contractors made little or no profit, and showed great reluctance in accepting new contracts. It was deemed reasonable that the rates should be increased sufficiently to leave a fair margin of profit to the contractors, and at the same time that the classification be revised so that the remuneration should be more nearly proportional to the cost of the survey. After consultation with all the surveyors who were engaged recently on township surveys, and who are conversant with present conditions, a new classification and schedule of rates was prepared and approved by Order-in-Council of February 3rd, 1903, which is attached to this report as Appendix No. 9. The remuneration for prairie work is not increased, but surveys in the woods are, in some cases, paid as high as $38.00 per mile. The classification is entirely new and somewhat complicated; it may be expected that experience will show the necessity of amendments.

MANUAL OF SURYEY.

The last edition of the manual of instructions to surveyors for the survey of Dominion lands was issued in 1892; it was a revision of the previous edition (1883) prepared, under instructions of the Deputy Minister, by the Chief Astronomer, Mr. W. F. King, and the Chief Inspector of Surveys, Mr. J. S. Dennis. A new revision had become necessary to bring our methods in accordance with the best modern practice, and to provide for the changes made in the system of survey during the last eleven years. The revision was prepared by the Surveyor General, and issued to surveyors before the beginning of the present season's operations. An important departure from the previous practice is that township plans, instead of being made by the surveyors as formerly, will now be plotted from their field notes by the office staff. The plans will thus be made uniform and accurate—they will be made in better style and will contain all the information necessary for the record of a land survey; there will also be less delay between the completion of the surveys and the issue of the plans. Throughout the manual, the governing idea is that the plan of a land survey must be a true representation of the survey as it exists on the ground, and not a conventional illustration of the survey which it had been the intention to make. For this and other purposes, new clauses and numerous amendments to old ones had been inserted. The old tables have been re-arranged and a new one compiled for the determination of the azimuth by the observation of Polaris. This last table will, it is believed, prove a most useful one to township surveyors; by its means, they may, at any time, in a few minutes, and almost without calculation, ascertain the astronomical bearings of the lines of survey. A very complete index is provided to facilitate references, and a large number of speciman plans and illustrations add to the value of the book. It is confidently expected that this manual will be found a very great improvement upon previous editions.

1908 REMUNERATION OF SURVEYORS.

At the inception of the survey of Dominion Lands, nearly forty years ago, Dominion Land Surveyors were paid five dollars per day. Shortly after, six dollars per day was allowed to surveyors of base lines. These rates remained in force until 1901, when they were increased to $6.50 and $7.50 respectively. The advance proved inadequate; in order to induce properly educated men to qualify as Dominion Land Surveyors, so that there should be no difficulty in securing the services of competent surveyors when they are wanted, a further increase of $8.00 and $10.00, respectively, was granted by Order-in-Council of March 30th, 1908. The increase, it will be observed, is for ordinary surveyors, 60 per cent. over the rate of forty years ago; for surveyors of base lines it is a little over 60 per cent. Considering the enhanced cost of everything, the increase does not appear too large. By the same Order-in-Council the salary of the Inspectors of Surveys was fixed at $9.00 per day in the field and $5.00 per day at office work.

In August, 1911, an Order-in-Council was passed authorizing the payment of $12.50 per day to surveyors engaged upon the survey of Base lines and Initial Meridians.

"INSPECTION OF SURVEYS."

In the earlier prosecution of the surveys, inspection was confined to a visiting of the various parties in the field by the Inspector to satisfy himself that they were really at work, and to judge by what he saw of their manner of doing it, whether the requirements of the contract were being duly complied with; but, unless he became aware of something to give him suspicion of error or neglect, no check measurements were made beyond that of an occasional rough testing of an angle, with a pocket sextant that could be carried about by a person travelling on horseback or on foot, and generally alone. This kind of inspection, though certainly inexpensive, proved to be correspondingly ineffective. It became evident that the cost must be incurred of applying check measurements to portions, chosen unsystematically, of each contract in order thus to insure the obtaining average samples of the work. Inspection surveys were therefore established. At first this consisted of lines run at random diagonally through a contractor's township and closing on the surrounding block outline surveys, with the object of having a rigid check both on the contractor and on the work of the inspection survey itself. This method was, however, abandoned on account of the labour it entailed in the office in obtaining, from the data, comparison of the actual position of boundaries checked, with that which theoretically they should occupy, and also because that the inspecting surveyor could judge but from what he saw at points where his lines intersected those of the contract, what care had been taken in placing its monuments.

To make a thorough inspection of a survey, it would be necessary to remeasure all its lines; in fact, an exhaustive inspection means a duplicate survey. This forms a fundamental objection to survey by contract. It is impossible that any Government officer can certify that the full value has been received by the public for the contract money paid, unless he has so executed or caused to be executed, a duplicate survey. The most, therefore, that is practicable, within reasonable limits of cost for inspection, is that tests should be applied here and there at hazard, throughout a contractor's work, and the inspecting officer report the resulting facts, together with a presumptive opinion based thereon, respecting the necessarily very much larger untested portion of the contract."

To obtain a contract, a surveyor makes written application to the Department for the sub-division of a number of townships (these contracts are limited in size from 4 to 8 Tps.) Before his application is accepted, he is requested to make himself conversant with the nature of the country in which his contract is situated. If he asks, he is given all the information possible that the Department has relative to the description of the country, *i. e.*, means of access, transportation, nearest post-office, railway and express offices. It is therefore through no fault of the Department if he accepts blindly a contract and does not take sufficient time to complete his work. Contractors in general would find it to their advantage if they paid more attention to entering on the contract forms the dates of commencement and completion of their work, as it would save both themselves and the Department a lot of unnecessary correspondence, besides worrying their sureties for an extension of time, etc. I would like to suggest that when contractors have a knowledge that the country they are going to work in is interspersed with numerous muskegs and unusually wet, it would be more advantageous to them to leave their work until the ground freezes. Nearly all our survey work now is in timber, in which there are great areas of swamps and muskegs, and the survey work (except mounding), can be done cheaper and just as accurately in the winter as in summer.

I presume every surveyor has his own particular method of conducting a survey, it therefore appears presumptious on my part to offer suggestions, however, I take the liberty of telling younger members of the profession, who are commencing contract work, that it is unnecessary to purchase a lot of horses, they are expensive and not absolutely necessary. Before going into your contract, establish a cache as near your work as possible and engage teamsters, half-breeds preferably, to haul your supplies there, and no matter what happens thereafter, you will at least have sufficient supplies to keep things moving; men will not work on empty stomachs. Make provision for your mail service at least once a month, it is absolutely necessary that you keep the Department informed of your movements and progress, many vexatious delays are apt to occur if you do not, and the Department is the one to suffer least. One thing I wish to impress strongly upon the contractors is the incorrect placing of ¼ section monuments on chords. The inspectors find this a very common error, after the chords have been cut out and chained, the contractor is apt to leave the offsetting of these monuments to the mounders, who in many cases (as experience has shown) are apt to be careless and offset, if at all, the wrong way, this makes a very bad showing in the bearings of the chords and the error appears worse than it really is.

Now, gentlemen, I think it would be in order and to the best interests of all concerned if we discuss a few of the most salient points in connection with contract work. The points that most frequently arise between the Inspector and Contractor, are the following:—

Opening of lines,
Blazing of lines,
Marking on posts,
Classification,
Mounds and pits, and
Traversing.

There are frequent complaints that some contractors do not open their lines wide enough. Personally I do not think it is the intention of the Department to require the surveyor to open lines wide enough to drive a wagon through, or cut off all trees and brush to within six inches of the ground. On the other hand, it is certainly not the intention to have lines so narrow that the line of sight can barely pass the trees. There should be a mean, and my own opinion is that no tree should be left standing that is within, say a foot of the line on either side of the line of sight. Of course there are exceptional cases, when the contractor runs against a tree close to the line, that is about three feet in diameter. In such isolated cases, I do not think the Inspector would worry the contractor very much if this tree was not cut down, but rabbit runs and lines of the "key-hole" variety should be condemned, and the bush and wind fall cut low enough so as to insure accurate chaining.

Blazing.—Clause 76 of the Manual, reads in part as follows:— "All lines are to be further marked by blazed trees not more than

75 links apart, and are not to be omitted when there are trees more than two inches in diameter within 50 links from the line. If this is not done, a maximum penalty of $2.00 per mile may be applied, see Clause 314."

In my opinion, the blazing of trees two inches in diameter is rather absurd, after a tree of this size is blazed on three sides little of the tree remains, at all events so much blazing is apt to kill it, thus rendering it useless as a permanent mark. I think this Clause should be amended to read 3 inches in diameter. I also think that trees blazed 50 links from the line is too far away, 25 links is quite sufficient for all practical purposes.

Markings on Posts.—These should always be distinct and cut well into the iron, and care taken not to mark on the Crown or Penalty side of the bar. The markings on the iron posts, in many cases, are but indifferently done and sufficient care not given to the driving of them into the ground. At Wintess corners, in addition to the distance and bearing from the true corner, the reverse side is to be marked with the section number only, and but one side of a quarter section post is marked. A quarter section corner falling in a lake or marsh not more than three feet deep is marked by a wooden post, flattened on two sides and marked. The post must not be less than five inches in diameter and long enough to be driven three feet into the ground and to show six inches above the water (Clause 152). Where there is a Witness mound and a wooden post for the same corner, in my opinion the Witness corner in case of dispute should govern.

Penalties are sometimes exacted for not driving the bars deep enough in the ground. There are cases where it is impossible to drive the bars the required limit, in rocky country, hard frozen ground, gravel and sand or in gumbo, and if you attempt to drive them in the top breaks off. The Inspector in such cases should use his judgement. Care should be taken that all posts are lined in correctly by the instrument, as upon their "exact location' depends the bearings of the lines, and precision of future surveys. In my opinion the square ends of the bars are not long enough, there is not sufficient room for marking large numbers. I have spoken to the Surveyor General about this, and he has promised that the next issue will have longer flattened ends. Bars should be driven in plumb.

Classification.—Clauses 311 to 314 of the Maunal describe in detail what is expected from the contractor.

As our subdivision surveys are now nearly all in bush country, interspersed with muskegs and marshes, it is therefore only in the openings, across water or marshes where there should be any doubt in the ratings. As all openings of half a chain are required to be recorded, it appears to me that there should be but little difference of opinion as to the nature of classification (Clause 316). The contractor is given the benefit of the doubt, as whenever he shows proof of actual cutting, no matter how small the scrub, he is paid 100% for his work. This also applies to park country, where he may only have to cut down a tree in every five or six chains. Where surveys are made in the winter and examined in the summer, or vice versa, there is apt to be a difference of opinion between the contractor and Inspector, as the topographical features are somewhat different, especially is this noticeable across muskegs, lakes, &c., &c. There appears to me good reason for argument in this proposition, as the Inspectors returns are apt to vary from the contractor's. If the work of the Inspector and contractor is done at different seasons of the year, consequently the returns in ratings will not agree.

Mounds and Pits.—There is a standard for the dimensions of all mounds and pits in the Manual of Survey (Clauses 154 and 155). It is no trouble to build mounds or dig pits in accordance with the standard, when the ground permits, and under such circumstances there is no excuse if not properly made, and a rigid enforcement of the regulations should be enacted. On the other hand, it is almost impossible to comply with these regulations, such as building mounds and digging pits in swamps and muskegs, the composition of the soil is such that when the mounds have been made the standard size, they will not retain their formation for any length of time, but shrink to almost half their original size; the same applies to the pits. The contractor builds them in water and muck and the Inspector frequently examines them in dryer weather, when the water has evaporated and the mounds and pits have in consequence shrunken considerably since being constructed. In such cases it seems to me hardly fair to impose a serious deduction on the contractor, unless the Inspector is thoroughly satisfied that the mounds and pits were carelessly constructed in the first place. In such cases the Inspector should use his own discretion, and when submitting his report to the Department, explain in full his reason for condemning or approving these mounds and pits; a little give and take on the part of the Inspector is in my opinion most desirable. Personally I have never been in favour of mounds in scrubby country, as experience has shown that they serve as an incentive to cattle and wild animals to stamp down, and supply additional material for filling in the pits, and now-a-days most farmers keep a few cattle. In the wilder regions the cut lines are regular pack trails for the wild animals. I consider that mounds built of earth, sod, stones and other material, will last longer and retain their formation better than if built of earth alone. Stone mounds, when properly built, form a good permanent mark, and if the iron bar is bent at right angles about the centre and one half of it placed under the mound, it will, unless willfully removed, remain in position for many years. It occasionally occurs that contractors place the iron posts at the East and West corners of mounds, and sometimes build mounds and pits square with the line, when they should be placed diagonally. These are small errors, but should not be overlooked.

Traversing.—Clause 105, states that a hub shall be planted firmly where the line intersects the bank of a lake or river which has to be traversed. Do all surveyors comply with this regulation?

Clause 137 states that along tidal waters, the line to be traversed is the high water mark at ordinary tides. For a lake or navigable river, and also where the Irrigation Act applies, for a river not navigable, the line to be traversed is the bank. The bank, be it understood as applicable to a lake or navigable stream, is the edge of the bed of the lake or stream, and the limit of the bank is the line where vegitation ceases, and the shore is the space between high and low water mark at ordinary tides. As the edge of a marsh is inadmissible as a boundary, and subject to change, it follows that an Inspector when making a traverse, should select a well defined boundary of a lake or river so that upon comparison there will be less likelihood of a disagreement between the Contractor and the Inspector's returns. Lakes that are traversed in the summer and inspected in the winter cause some trouble, as shore lines in many cases are bound to vary under the changed climatic conditions. It is permissible to make traverses with the chain, stadia or micrometer, if by the latter, the closing error must not exceed one chain in one hundred and the distances measured must not exceed half a mile. Traverses of lakes, rivers and connecting traverses are paid for at the rate of $11.00 per mile, and the distance paid for is between fixed points in a straight line.

Observations.—Clause 111, reads as follows:—

In subdividing Townships at least one astronomical observation for ascertaining the direction of the meridian is made in each township, but two or more are desirable, &c., &c. When the weather is not favourable for observing, work may be commenced with an assumed meridian, and if possible connected by angular measurement with a base line. The telescope now used is powerful enough to show stars of the second magnitude within a few hours from noon, and stars of the third magnitude in twilight when it is still clear enough to read the graduation. The observation should be taken in daylight whenever practicable.

A complete observation under favourable conditions, give a result correct within a few seconds.

An observation for time should be taken either shortly before or after every azimuth observation.

No. 1.—Many contractors have trouble with the survey of the N. and S. boundaries of Townships. The Manual states distinctly that these lines must be run twice; well, if the contractor does not comply with this regulation but offsets his mounds, and the Inspector finds out, why blame the Inspector for reporting the condition of affairs. He is simply doing his duty and following instructions. (Clause 94, Manual of Survey).

No. 2.—Naturally the Inspector can only examine a small percentage of the work done in a contract, and if he finds, upon examination of a few miles of line, "good work," he will not spend unnecessary time retracing more lines in the contract. On the other hand, if he finds the work carelessly done, he has to make further examination in order to thoroughly satisfy himself that the contractor's work is acceptable or otherwise.

No. 3.—Contractors should bear in mind that the Inspector does not enter a contract with the avowed purpose of finding fault with everything he looks at. It does not matter to the Inspector whether the work of the Contractor is right or wrong, but from a personal point of view he would far rather find good work, as it saves him additional work and worry. I have always found it a good idea when inspecting contracts, to retrace the boundaries of two adjoining sections, by so doing, you check your own closings as well as the contractors, and in fairly good work and country, an Inspector can generally retrace six miles in one day, and finishes where he commences work in the morning, near his camp, thus avoiding unnecessary long walks.

Now, Mr. Chairman, I have endeavoured in as few words as possible, to give a brief resume of the general growth and expansion of the Interior Department in connection with our Survey Branch, from its inception in 1873. I have also tried to touch on the important points in reference with Inspection of Surveys, I know there are omissions and probably errors in my data, but it is a large subject, and I hope my effort will at least be of value for further discussion by the members of our Association.

I thank you gentlemen for your patience.

Schedule giving Names and Dates of Ministers, Deputy Ministers, and Surveyors General of the Department of the Interior, Since the Inception of the Department in 1875.

Year.	Ministers.	Deputy Ministers.	Surveyors' General.
1873	Hon. Alexr. Campbell.	E. A. Meredith.	J. S. Dennis.
1874	Hon. David Laird.	“	“
1875	“	“	“
1876	“	“	“
1877	Hon. David Mills.	“	“
1878	“	Lt.-Col. J. S. Dennis	Lindsay Russell
1879	Sir J. A. Macdonald.	“	“
1880	“	“	“
1881	“	“	“
1882	“	Lindsay Russell.	“
1883	Sir D. MacPherson	“	“
1884	“	A. M. Burgess.	“
1885	“	“	E. Deville.
1886	Hon. Thos. White	“	“
1887	“	“	“
1888	“	“	“
1889	Hon. E. Dewdney.	“	“
1890	“	“	“
1891	“	“	“
1892	“	“	“
1893	Hon. T. M. Daly.	“	“
1894	“	“	“
1895	“	“	“
1896	Hon. H. J. Macdonald.	“	“
1897	Hon. C. Sifton.	James A. Smart.	“
1898	“	“	“
1899	“	“	“
1900	“	“	“
1901	“	“	“
1902	“	“	“
1903	“	“	“
1904	“	“	“
1905	Hon. F. Oliver.	W. W. Cory.	“
1906	“	“	“
1907	“	“	“
1908	“	“	“
1909	“	“	“
1910	“	“	“
1911	“	“	“
1912	Hon. R. Rogers	“	“
1913	Hon. Dr. W. J. Roche	“	“

Mr. Aylsworth: Gentlemen, you have all heard this very valuable contribution. A few years ago we had an article by Mr. Wallace, of Calgary, on the Surveys of Alberta. It was hoped then that there might be a Wallace grow up in Saskatchewan and another Wallace in Manitoba, to give the description of the Surveys in those provinces. Now we have heard a Wallace on Inspection Surveys this afternoon. It was with much pleasure that I listened to Mr. Hubbell's historical reminiscences. It is a very valuable contribution, and there may be points in it for discussion.

Mr. Ransom: Last year I had a long discussion with two surveyors, about the traversing of rivers. Part of the river was navigable and part unnavigable. From going carefully through the manuals we could not just be sure whether both sides should be traversed, and I think it might interest others, and I would like to know the opinion of others on the matter.

Dr. King: I have listened with very great interest to the address delivered by Mr. Hubbell. I have been out of touch for a long time, but I have listened with very great interest to the early history of the surveys. When I was connected with them, I was in close touch with the people who directed them. There was one part of Mr. Hubbell's address that I would like to remark on if he will allow me, and that is where he says special survey work was carried on by Mr. Lindsay Russell, assisted by Mr. King, in 1875. I was only one of fifteen or twenty assistants. Only a pupil, one of three computators, and I had some little scientific work to do always. Special surveys were divided up into sections. There was an eastern section under Mr. Russell, and Mr. J. S. Dennis had charge of the western section. During these years I had charge of the astronomy section. We had a very large stock of iron posts and I had to see that surveyors were properly supplied with these posts. Sometimes posts would not reach the surveyors for several days, and they would probably send in a bill for damages. But we managed to get through in some shape or other. I shall conclude by saying again that I think Mr. Hubbell's paper was a very valuable one, and I shall be glad to hear more of such papers.

Mr. Hubbell: I appreciate Dr. King's remarks and thank him for drawing my attention to a clerical error.

Mr. Dennis: Replying to Mr. Ransom's remarks about traversing a river, I think Clause 137 of the Manual states that for a lake or navigable river the line to be traversed is the bank.

Mr. Ransom: The question I wanted to raise was that of a navigable river of less than three chains, should there be a line on both banks?

Mr. Dennis: I think it might be done either way. If you do it on the ice, one line would be sufficient, if on the bank two lines.

Mr. Hubbell: Instructions are given to a surveyor when he is to traverse a stream or river. I have known a surveyor to traverse one side of a river and obtained the other side by a system of triangulations.

Mr. Aylsworth: I am sure the meeting would like to hear from some of the contractors.

Mr. Watt: I would like to say to the Inspector that if the contractor were allowed, say half rate for cutting the line on the north side it would help him in getting a better boundary. I think that the north boundary would be cut out much better than it is at present, and the surveyor would feel that there is something in it.

Mr. Hubbell: This has been a subject of discussion for a great many years, but as I look at it, when a man accepts a contract he knows he has certain conditions to comply with, and one of these conditions is that he has to run this line twice. It is a question that could be discussed, but as it stands the north boundary is going to be paid for but once, and it has got to be opened twice.

Mr. Watt: What I asked was would it not be better for the north boundary, if some allowance were made for cutting it?

Mr. Hubbell: If I may be allowed, in connection with contract work, I think a good point to bring up some time would be the cutting of trails through woods. A great deal of time is spent in cutting trails which are utilized by settlers to open up the country. Contractors also spend a good deal of money and time in building bridges.

Mr. Aylsworth: It seems to me (not speaking authoritatively) that some oil might be thrown on the waters along this line. Mr. Hubbell said he knew that the contractor could not be paid a second time, and that he took the contract under certain conditions, but at the same time, if there was some little provision made along that line it seems to me that it would let the contractor out a little easier.

Mr. Nelles: I would like to ask a simple question as to the scientific method of driving posts into hard ground.

Mr. Hubbell: Where there are stones and gravel, you may of course try and drive them in and do the best you can. That is a case the Inspector would have to report on as he found it. You cannot drive posts into stone and there is no provision made for it.

Dr. Deville: I have listened with a great deal of attention to Mr. Hubbell's paper, and to the discussion which has followed. The only regret I have is that there are not more papers like it. I think it an exceedingly valuable paper, and more particularly for the advice that it gives to young surveyors. Mr. Hubbell is one of the most experienced surveyors that we have. He has been in the West a good many years, and what he does not know about the management of survey parties is not worth knowing. The position of Inspector is a very hard one, and it is very difficult to please everybody. At the same time it becomes increasingly difficulty to manage contract surveys. When we had no inspectors, everything was lovely. (Laughter). Then there is the question of classification. It has been pointed out that this classification is unfair, and no doubt in a good many cases it is, and I would like someone to devise a classification that would be satisfactory in every sense, we would be glad to adopt it right away. We have not yet succeeded in devising one ourselves.

Now, if I may be allowed to repeat what I said this morning, respecting the payment for the survey of township outlines, what difference does it make whether you have one or two rates so long as you obtain the same total in dollars and cents, and if so why should you complicate our arrangements by establishing two rates where one will give the same result? That seems to me to be common sense.

Other points which have been raised are the marking of corner mounds and posts and such things. These difficulties are met in carrying out the instructions of the Manual is to be expected, and I am quite prepared to admit that there must be cases where they cannot be carried out, but what are we to do? You say for instance that it is of no use making mounds or doing this or that. That would be an interesting subject for discussion. Some of the suggestions made by Mr. Hubbell deserve serious consideration. I do not see that there is anything to prevent doing some of the things he advocates. More of these suggestions would do a great deal of good. Mr. Hubbell's paper is a very valuable one, and one for which we are indebted to him.

Mr. Ransom: I should like to express my appreciation of the fact that any suggestions I have made on my contract work were always received very favourably and were usually acted upon. In my contracts I have been very pleased with the Inspector, who was right on the job where I was working. I think he understood the conditions of the work better than he would by coming at a different season of the year.

Mr. White: Mr. Hubbell, in his paper spoke of the making of mounds in a wooded country where it was dry, were almost invariably trampled down, either by moose or by cattle. As regards mounds made in a wet country where deer or cattle are plentiful, they are bad things for the permanency of the mounds. Sometimes during the night a moose would come along and almost fill the pit before morning.

Dr. Deville: The mounds in wooded country were adopted after consultation with a great many surveyors. We found when we reached the Western plains that it was impossible to keep mounds in the prairie. The cattle saw the mound from a distance, went for it, at once destroyed it and filled the pits. On the advice of the surveyors, it was decided to do away with mounds in prairie, but, it was held that they were a necessity in the woods. It may be that the surveyor that made the statement about mounds in the woods, just now, was in a country where moose and deer were numerous.

Mr. White: The moose did not do so much harm as the cattle.

Mr. Aylsworth: Well, gentlemen, the discussion seems to be about complete. With regard to mounds I have had seventeen years experience and I think that the system now carried out of mounding a township in the woods with iron posts is as perfect as can be invented. There is no power on earth that can destroy that survey and when I have done that work I am proud to think that my work is there "For keeps," as the Irishman would say.

There is one other point. The very meagre bill of fare that has been supplied in the way of papers. I need not mention that if we had more papers it would be more beneficial to the Association. I am sure it is not right that we should not have more papers than this, but we have done everything possible for the future to remedy this matter. In the past this work has been left entirely to the efforts of the Secretary. He has a great deal of work to do, and perhaps better results can be obtained by appointing a Committee whose duty it would be to collect papers. We all know that it is not a good time to get ready for the annual meeting about a month before it takes place, so we have decided to appoint this Committee, and let them go to work now, and I think that our Committee will be able to get some good results. A man can prepare his paper when he likes. Perhaps he will do it during the summer, when he is on his vacation, or at any other time it suits him.

Mr. Nelles: I have been promised four papers for next year.

Mr. Hubbell: We must not devote too much time to papers, we want a certain amount of time for discussion. Let us have a good bit of discussion as we are doing now. That is what we want.

Mr. Nelles: That is perfectly a good idea, but the papers need not necessarily be read before our meetings.

Mr. Aylsworth: Then again, they have in some Associations what is called a question drawer. Anyone may send in a question he is in doubt about and have it solved, then they have a question drawer Committee. The question is brought before the Committee and they give their opinion on it and they have a time arranged for its discussion.

Mr. Fawcett: The question drawer contains questions relating to survey work that are not very clear and are in dispute, and they are brought before the Committee who are generally experienced surveyors. The questions are brought up for discussion at the meeting, and a solution can either be accepted or not.

Mr. Aylsworth: A question like "Which side of the river would you traverse, or will you traverse both sides" is a good question.

Mr. Fawcett described a case where there was a point settled in the courts which rested on that very question.

Mr. Dennis: With respect to papers, I might mention that Mr. A. Sumyor promised to give a paper on the Geodetic Survey work, but he has had some special work to do lately and could not prepare it. Another gentleman also promised to give a paper, but he has been too busy to get it out in time.

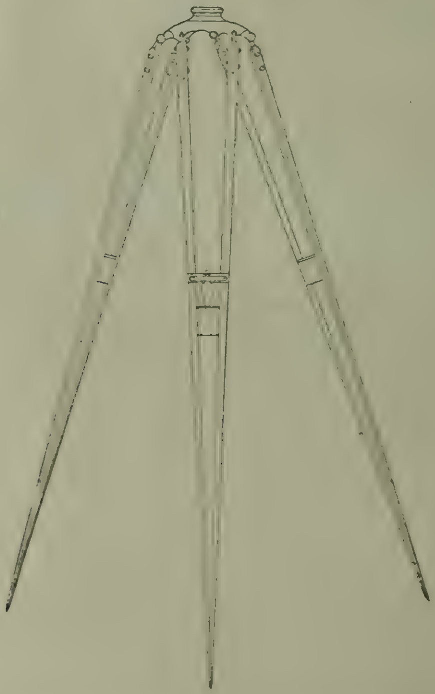
Mr. Aylsworth: This concludes the meeting, except the address on Forestry, and I need not mention to you the importance of this subject to all surveyors and to all Canadians. In the present condition of the quickly decreasing amount of timber, and the high cost of lumber, and I would ask you to take advantage of this interesting address to-night at 8 p.m. Ladies are invited.

PLUMB BOB HOLDER.

F. H. Kitto, D.L.S.

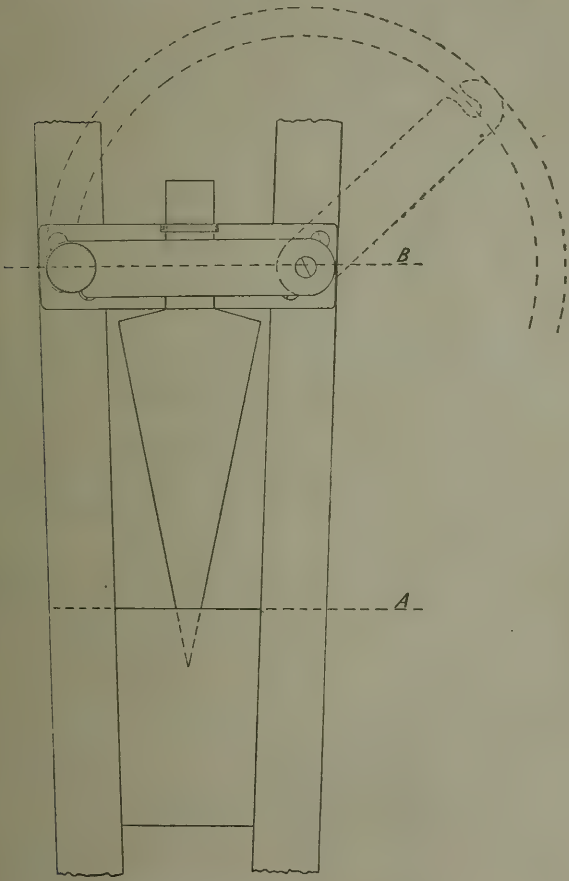
The carrying of the plumb bob from station to station, or to and from the line, has always been a source of annoyance to the transit-man. It will persist in punching holes in pockets and getting lost somehow or other.

Last year I overcame all this trouble by a simple little attachment I had made to one leg of my tripod, and in which I always place my plumb bob when not using it. Not only do I use this attachment as a pocket for carrying the plumb bob about, but as a permanent receptacle for it, so that whereever the tripod may be, the plumb bob will be with it. It not only does away with the trouble of carrying a plumb bob, but also with the danger of finding oneself without one.



Showing plumb bob carried on tripod.
Fig Nº 1

The attached sketches will show the idea in detail. No. 1 figure shows how and where the plumb bob is carried. In a split-leg tripod the position it occupies is convenient and not the least in the way. Figure No. 2 shows the plumb bob in place. The point of the plumb bob is safely disposed of by dropping it into a hole ¼ inch in diam. bored to a depth of ½ inch in the center of the wood cross-piece of the tripod leg. The neck of the plumb bob rests in a strip



Plumb bob in holder
Fig. No. 3

of brass extending across the split of the tripod leg. This strip is fastened at each end by two half-inch screws. The two holes shown midway between the screw holes are for the fasteners of the outer plate. This brass strip is bent to a curve at the center so as to fit the neck of the tripod. More detail is shown in figures 5 and 6. figure 3 shows the plumb bob held in place by inner and outer plates. The outer strip is of brass and hinged at one end on a round headed inch screw, which passes through the inner plate and screws firmly into the wood. The other end hooks over a pin which is fitted as a clamp screw, so that by a slight turn of the mill headed thumb nut the plate cannot come unfastened and lose out the plumb bob. This screw extends through the wood of the leg and tightens in a nut, which is fitted by two $\frac{3}{8}$ inch screws to the inner side of the leg. figure 4 shows the arrangement from the inside of the tripod leg, showing the nut in place. Figure 5 shows a cross section at A and B, as indicated in figure 3. It will be noticed that the inner plate is bent in such a way that the neck of the plumb bob does not exactly fill it, but is gripped on either side. This is to allow for string which is generally wrapped around the neck. As the plate will spring according to the thickness of string, the plumb bob is always held firmly. Figure 6 shows details of the individual pieces.

This is a very simple contrivance, easily made and easily fitted to the tripod; and yet I have received more satisfaction from this little arrangement than I can tell. I never think of taking the plumb bob out of this holder, except when I want to suspend it. There is no more convenient place for it when carrying the transit, or when the transit is in camp, on transport or in the office. It cannot be lost and it cannot be forgotten. I am having my new tripod fitted up with the same style holder as I would not start out now without it.

It will be noticed that this holder is made to suit the split-leg tripod and a 12 oz. plumb bob, but such a scheme could be adopted to any tripod or plumb bob.

Note.—Owing to lack of space it was decided not to print sheets No's 2, 4, 5 and 6 referred to in the text.

FORESTRY.

By R. H. Campbell, Esq., Director of Forestry.

I appreciate highly the honour of being invited to address the Dominion Land Surveyors' Association, and the opportunity of explaining to the Association the work which the Forestry Branch is trying to carry out. The support of such a body as this Association will be very helpful in our work. I would also like to acknowledge how much forestry work owes to the surveyors. Mr. E. Stewart, the first Dominion Superintendent of Forestry, was a Dominion Land Surveyor, and it was as a result of his observations of the condition of the forests made while he was carrying on surveys that he brought the matter to the attention of the Government, and was able to induce them to take special measures for Forest protection. Surveyors are also very helpful by enabling us all to locate ourselves when we go out into the forest. Until the surveyor comes along and lays down the lines, we find it difficult to locate the timber or map out the areas that we have to administer.

In considering the forest and its development, it is necessary to have clearly fixed in our minds the fact that the forest is a living thing, and that it grows and developes according to natural laws. In order to understand the forest, therefore, it is necessary to study the habits of life of the tree. The four great requirements for tree life are water, light, air and soil, and it carries on its functions of life and growth very much in the same way as animals do. One of the great differences, however, is that the tree is in a fixed position and therefore cannot go to find its food or requirements where they may be. It is therefore necessary for it to adapt itself to the conditions as they exist where it is located. We will look at the materials which the tree requires for its growth, and then consider some of the adaptations that are necessary so that the tree may make use of them.

Water is the most important constituent for the use of the tree. The tree is continually drawing up from the earth through its roots, large quantities of water which pass up from the trunk and are exhaled from its leaves. In order to keep the tree in a healthy condition this flow of water must be kept constant, and the more freely the water passes through the tree the more vigorous will be its growth. We see this very clearly by following different characteristics of the tree growth in different portions of the Dominion. On the coast of British Columbia, in a moist climate, the growth of the tree is very vigorous and we have the immense Douglas Firs and Cedars that form one of the most magnificent forests in Canada. In the forests of the Selkirk Mountains, in the central part of British

Columbia where the rainfall is still heavy, there is a vigorous growth of white pine, cedar and fir. In the dry belt in the Province of British Columbia, the mountains which receive the most of the precipitation are covered with a dense forest of lodgepole pine and fir, but in the lower portion of the dry district, where the rainfall is scanty, the forest thins out and there is a scattered growth of yellow pine. In the prairie country the Rocky Mountains carry a stand of lodgepole pine, Englemann's spruce and fir, which is more or less of a mountainous character and therefore not so large in size as the forests of the Selkirk Mountains or the coast of British Columbia. The reason for this is that ascending the mountains or going northward in latitude the soil is cold for a longer period during the year, and this has a considerable effect on the rate of growth of the trees.

The trees are not directly affected by the lowness of the temperature, as some specimens of trees are found growing in the barren lands to the north, away beyond the general line of tree growth. The effect of the cold is, however, to keep the ground frozen for a great portion of the year, and therefore to prevent the tree from obtaining a supply of water with the result that it cannot continue its functions. You will know from your own observations and from the views I have shown that in the muskegs of the north country the trees are very slow in growth and stunted. This is partly the result of the fact that the ground is kept very cold by the covering of moss, and therefore the growth is slow, but it is also partly due to the fact that there is considerable acid in the water of the muskegs and consequently the tree cannot make use of the water as it could if it were pure. The method by which the water passes from the outside of the rootlets to the inside is a physical one dependent on chemical composition. If the water outside is a stronger solution than that inside the root, the water will not pass in and consequently the tree cannot get the use of it.

As you reach the northern latitudes or the alpine elevations of the mountains, the tree growth becomes more stunted until finally it lies almost like a mat on the surface of the earth, as illustrated by the view of the white barked pine at an altitude of 6,000 feet on the Porcupine Hills in Alberta. This flattening out of the growth is partly due to the fact that the water supply is not sufficient, and that it is difficult to get the water pumped up if the tree grows to a greater height than the ordinary level, and partly to the fact that the drying wind increases so largely the transpiration that the supply of water cannot be obtained quickly enough in a soil which is so cold for such a great part of the year.

The effect on trees of light and air have been partially explained, but they are illustrated by the view of a red oak growing in the open, which shows wide spreading branches from the lower part of the trunk to the top of the tree. The tree has had light and air from the beginning of its growth, and consequently has spread out its limbs and leaves in order to obtain as much of both as possible.

To counterbalance the great extent of the tree above ground, it is necessary also that the root should extend deep and wide in the earth in order that the tree may not be overthrown by the wind. The growth of the tree in this manner is not, however, the most satisfactory for producing lumber, as the lumber produced will be knotty and will have a very small proportion of clear stuff. In order to produce the best quality of lumber the tree should be grown in a close stand, as shown by the views of stand of lodgepole pine on the Cypress Hills in the province of Alberta. Here the trees have been sown close together and are reaching upward toward the light, each one trying to get its crown where it can get the most light. As a result the trees grow rapidly upward and the inside branches dry off and gradually drop from the tree, leaving a long, clear trunk. Many of the trees in such a stand will finally become suppressed by the more vigorous ones and will gradually die out completely. In the forests of Europe such trees would be taken out by a thinning process, but in this country the market conditions do not make such thinnings possible, although in a district like the Cypress Hills, where there is no other timber within one hundred miles, there seems to be reason why thinning might be done profitably.

The soil has considerable influence on the growth of trees. We find that on the light, sandy soils the pine will grow readily, particularly the red pine and the jack pine. As a rule, however, trees will grow best in a fairly good soil, and the forest floor covered by leaves and debris from the trees finally forms a bed of humus which provides excellent nourishment for tree growth. The Province of Ontario is now taking active steps to replant pine on some of the sandy areas in the western part of the province which have been entirely denuded and left bare of trees or any other useful growth.

In order to meet the different conditions as explained above, the tree has to arrange various adaptations. Sometimes the tree is in a location where water can be obtained plentifully. and in such case it is arranged that water will pass through the tree rapidly and escape. Such trees usually have broad leaves with thin coverings and numerous openings called stomata from which the moisture may escape. Trees or plants growing in dry situations, on the other hand, have devices for retaining the water as long as possible. One of the clearest examples of this, is the cactus growing in the deserts of the western United States, and even in the dry districts in the southern part of the prairies. The cactus has thick leaves containing a great many water vessels, and these leaves are covered with a close covering through which water cannot pass very easily. As a consequence all the water which the plant draws up from the earth is retained in the plant with almost no loss.

While the tree draws up water from the earth, bearing a few mineral salts, its chief sustenance is the carbon drawn from the air through the leaves. The fact that the tree is largely composed of carbon can be seen in any burnt district. The carbon is supplied largely from carbon dioxide in the air. In order to carry on its process of obtaining the carbon from the air, which process is carried on by assimilation in the leaves, it is necessary that light should play upon the leaves as fully as possible. Consequently the leaves are spread out so as to catch as much light as they possibly can. This is illustrated by the broad, flat leaf of the maple, arranged upon the stem so that the broad, upper portion of the leaf should always be exposed as much as possible to the sun. In the case of the coniferous trees the leaves are small, but this deficiency is made up by their leaves being very numerous.

The stem is so arranged as to provide for the water supply from the root passing up readily, and it is a very interesting process to investigate. It is not yet clearly understood how the force is supplied which will drive up the water required for one of the giant trees on the Pacific Coast two or three hundred feet through vessels of microscopic size. Various theories in regard to the matter have been put forward, and it was thought at one time that the matter was settled by an explanation that the pulsations of the living cells of the trees resulted in a pumping process which gradually forced the water upward. This theory is not, however, accepted as final at the present time.

Each year of growth adds a distinct ring to the woody tissue of the tree. In the spring the cells of wood are large with thin walls, and late in the summer are small with thick walls, and this makes the distinction between the growths of different years. The growth of a year may be larger or smaller according to the season. The favourable season will make the ring of growth larger, and a dry season will make it considerably narrower. Trees which are suppressed will also make slower growth than those which are open to light and air.

The bark gives protection to the growing parts of the trees, and as the tree increases in size the outer bark dies and is split open by the pressure from the inside, resulting in the corrugated bark which is so characteristic of many trees. The rough bark is characteristic of the white pine, elm and many other species. The bark in other cases, like the spruce, strips off in flakes, and that of the white birch exfoliates in thin sheets.

There is added to the natural conditions which have to be considered in the growth of the trees, an artificial condition caused by fire. Fires have occurred in all our wooded districts, and the evidence of their destructive power is clear to any person who has travelled through the timbered districts. Fires make the condition more difficult inasmuch as they make it harder to carry out the protection of a forest, and that they have made the conditions for reproducing the forest more difficult than they would be naturally. Where a tract is well covered with forest trees the cutting can be done so as to favour natural production, but where a forest fire sweeps through, the conditions are changed without regard to what is to follow, and we have to try afterwards to bring about the conditions that would have been considered and provided for if the removal of the forest had been done in a regular way. The vast stretches of forest that have been destroyed by fire mean a great loss to the capital and industry of the country, and means for combatting them are of prime importance.

The methods taken for handling the forest on better principles are:—

1. The provision of a fire patrol. We have a large number of fire rangers patrolling the forests by foot, by horse, by canoe or boat, during the dangerous season in the summer. These men put up notices warning people of the danger of fire, and instruct every person that they meet as to the necessity of taking care in the use of fire. On the Saskatchewan River, and one or two other places, we have put on a patrol boat. In such cases there are large stretches of water from which the forest can be reached and in this way a very much larger area can be patrolled than can be done in any other way. The work of the fire patrol may be illustrated by the work that is done in the portion of Manitoba north of Lake Winnipeg. This district is in charge of Mr. Jas. T. Blackford, with headquarters at Norway House. The canoe routes for the country to the north and down towards Hudson Bay all start from Norway House, and here he has an opportunity of meeting the parties that are travelling and warning them in regard to the danger of fire when they are starting out. Fire notices are posted at all the portages along the canoe routes, so that the matter is brought immediately to the attention of any parties when they go into camp. Mr. Blackford has also been successful in interesting the Indians in the matter of fire protection. He has talked to them about the matter when they are gathered for treaty payment and has induced them to promise to put out their

own fires and have others do the same. One of the views shows the Indians in a body raising their right hands and promising to put out their own fires and to try and induce others to do so. Every one of the Indians who promises to do this receives a small fire ranger's badge in the shape of a maple leaf, and they are very proud of these badges and wear them all the time.

On the forest reserves where matters are more fully under control, and the line between agricultural and forest lands is permanently settled, we take further steps for fire fighting by making permanent improvements of various kinds. In a tract like the Cypress Hills, where the prairie comes immediately in contact with the forest, plowed fire guards are made so as to prevent prairie fires sweeping into the timber. Such fire guards have been found of great advantage in holding back fires. One of our illustrations shows, in addition to the plowed fire guard, the poles of the telephone line which has been erected in order to have communication through the forest with the object of getting word about the fires out quickly and getting help in to fight them. In the forests of Europe the telephone is being largely used, and it is also being used very considerably on the forest reserves of the United States. It is one of the most useful adjuncts to the fire preventive work that can be had. The work of fire prevention in the forests is on the same principle as the work of fire prevention in the city; that is, the fire must be located quickly; notice of it must be given without delay; and help must be got to it speedily. This means the opening up of communication of all kinds—trails, roads, telephone lines, etc.

Another matter that has to be dealt with in order to meet the fire difficulty is the disposal of slash resulting from lumber operations. The illustrations show the condition of the forest after lumbering operations where the ground is covered with the debris of tops and branches forming fuel for a fierce fire and one which it is almost impossible to fight. The methods proposed for disposing of this debris is to have it piled and have it burned at a season when there is no danger of its spreading. Another method is to have the lower and upper branches of the top lopped so that the top will fall flat on the ground and rot away more quickly. This reduces the time of the danger by a few years, but until the tops rot it leaves a dangerous situation. On the whole the best method will be to pile the tops and burn them, and in Minnesota it has been found that this work can be done for 25c. per thousand feet board measure. In Europe, all material produced by the forest is of value so that the question of the disposal of slash is not a difficult one there. It will be many years before that condition is reached in Canada.

In order to provide for replacing cut over forest by a new growth there are two main methods; one is to do the cutting so as to leave seed trees or groups of seed trees so that a supply of seed may be furnished for the reproduction of the trees. In Canada the natural reproduction is good, as a rule, and as the method of artificial reproduction is somewhat costly, the former method will be followed generally. However, in some cases the forest has been so depleted on lands that are non-agricultural that it is necessary to make arrangements for reforestation. Such a tract is that in the Spruce Woods Forest Reserve in Manitoba, and we have started a nursery there with the object of growing young trees and replanting the denuded areas from the nursery. The illustrations show the method of establishing seed beds in the nurseries and transplanting the trees into the larger beds before they are finally ready to plant out in the forest at the age of about three years. When the trees have reached that age they are planted out in the place where they are to grow finally. In the western prairie district the trees are usually planted about four feet apart in order to give them as much protection as possible. Planting at this distance will mean that considerable thinning should be done at a later stage, and possibly by the time the trees have reached that stage thinning will be a commercial possibility. In many cases, however, the trees are planted as much as eight feet apart.

The whole object of the work that is being undertaken is to finally produce a forest such as that shown in the illustration of a tract in the Black Forest in Germany, where there is a regular stand of clear timber producing a large quantity of wood regularly every year. The danger of not looking after the tree growth is shown by the bare and denuded mountain sides of many places in China where forests once flourished; by the bare, rocky hillsides in the Holy Land where a few small shrubs and grasses are gathered for fuel; and by the bare mountain sides of several districts in France where millions of dollars had to be spent for works to control the flow of torrential mountain streams and to replace the forests which have been destroyed by fire and close grazing.

Note.—Many beautiful and instructive illustrations in connection with Mr. Campbell's able address were exhibited during the course of the evening.

LIST OF MEMBERS.

◆

HONORARY MEMBERS.

Hon. Patron:

Deville, E., LL.D., D.T.S., Surveyor-General, Interior Dept., Ottawa.

Hon. President:

King, W. F., C.M.G., LL.D., D.T.S., Chief Astronomer, Interior Dept., Ottawa.

Hon. Members:

Campbell, R. H., Supt. of Forestry, Interior Dept., Ottawa.
Casgrain, Hon. J. P. B., D.L.S., Senator, The Senate, Ottawa.
Klotz, O. J., LL.D., D.T.S., Assistant Chief Astronomer, Interior Dept., Ottawa.
Magrath, C. A., D.T.S., International Waterways Commission, Ottawa.
Stewart, W. J., Chief Hydrographer, Marine Dept., Ottawa.
Symes, P. B., Cor. Lyon and Somerset Sts., Ottawa.
Dennis, J. S., D.T.S., Commissioner of National Resources for C.P.R., Montreal.

Date of
Election.

LIST OF ACTIVE MEMBERS.

1912—Akins, J. R., D.L.S., Dunvegan, Alta.
1909—Ashton, A. W., D.L.S., Surveyor to Grand Trunk Pacific Ry., Fitzhugh, Alta.
1907—Aylen, J., D.L.S., North Bay, Ont.
1907—Aylsworth, C. F., Jr., D.L.S., Madoc, Ont.

1913—Baird, W. J., D.L.S., Scarboro P. O., Ont.
1910—Barber, H. G., D.L.S., Interior Dept., Ottawa.
1907—Bayne, G. A., D.L.S., c|o Hudson's Bay Company, Winnipeg.
1907—Beatty, D., D.L S., Parry Sound, Ont.
1907—Belanger, P. R. A., D.L.S., Inspector of Surveys, 49 Daly Ave., Ottawa.
1910—Belleau, J. A., D.L.S., Interior Dept., Ottawa.
1912—Bennett, G. A., D.L.S., Eden, Ont.
1912—Berry, E. W., D.L.S., The Rectory, Seaforth, Ont.
1910—Bigger, C. A., D.L.S., Geodetic Survey, Ottawa.
1909—Bingham, E. R., D.L.S., 418 Victoria Ave., Fort William, Ont.
1911—Blanchet, G. H., D.L.S., Lac la Biche, Alta.
1913—Boulton, W. J., D.L.S., Mattawa, Ont.
1907—Bourgault, C. E., D.L.S., St. Jean Port Joli, P.Q.
1910—Bourgeault, A., D.L.S., St. Jean Port Joli, P.Q.
1912—Bowman, E. P., D.L.S., West Montrose, Ont.
1907—Brabazon, A. J., D.L.S., Interior Dept., Ottawa.
1909—Brady, Jas., D.L.S., Golden, B.C.
1907—Bray, L. T., D.L.S., Edmonton, Alta.
1910—Bray, S., D.L.S., Indian Dept., Ottawa.
1910—Brenot, L., D.L.S., Fort St. John, B.C.
1910—Bridgland, M.P., D.L.S., Box 257, Calgary, Alta.
1912—Brownlee, J. H., D.L.S., 325 Homer St., Vancouver, B.C.
1913—Buchanan, T., D.L.S., 140 Jasper Ave., Edmonton, Alta.
1907—Burgess, E. L., D.L.S., Interior Dept., Ottawa.
1912—Brown, Thos. W., Box 438, Saskatoon, Sask.

Date of
Election.

ACTIVE MEMBERS—*Continued.*

1912—Calder, J. A., D.L.S , Ashcroft, B.C.
1913—Cannell, H. W., D.L.S., Dept. Interior, Ottawa.
1911—Campbell, A. S., D.L.S., Cor. King and Brock Sts., Kingston, Ont.
1910—Carson, P. A., D.L.S., Kamloops, B.C.
1913—Carthew, J. T., D.L.S., Edmonton, Alta.
1909—Cautley, R. W., D.L.S., Surveyor to Land Titles Office, Edmonton, Alta.
1912—Chase, A. V., D.L.S., Orillia, Ont.
1909—Chilver, C. A., D.L.S., Walkerville, Ont.
1913—Christie, U. W., D.L.S., Interior Dept., Ottawa.
1910—Christie, Wm., D.L.S., Box 74, Prince Albert, Sask.
1912—Clements, F. S., D.L.S., Box 49, Prince Rupert, B.C.
1909—Cleveland, E. A., D.L.S., Flack Block, Vancouver, B.C.
1910—Clunn, T. H. G., D.L.S., Interior Dept., Ottawa.
1909—Cochrane, M. F., D.L.S., Interior Dept., Ottawa.
1913—Coltham, Geo. W., D.L.S., Box 264, Aurora, Ont.
1907—Coté, J. L., D.L.S., Edmonton, Alta.
1910—Cotton, A. F., D.L.S., New Westminster, B.C.
1912—Cowper, G. C., D.L.S., Welland, Ont.
1909—Craig, J. D., D.L.S., Interior Dept., Ottawa.
1913—Cummings, A. F., D.L.S. Fernie, B.C.
1910—Cumming, A. L., D.L.S., Hotel Cecil, Edmonton.
1907—Currie, P. W., D.L.S., Interior Dept., Ottawa.

1911—Davies, T. A., D.L.S., Edmonton, Alta.
1911—Day, H. S., D.L.S., Marchand Apartments, Edmonton, Alta.
1908—Deans, W. J., D.L.S., Inspector of Surveys, Brandon, Man.
1912—de la Condamine, C., D.L.S., Box 1774, Calgary, Alta.
1911—Dennis, E. M., D.L.S., Interior Dept., Ottawa.
1912—Dennis, M., D.L.S., Interior Dept., Ottawa.
1907—Dickson, H. G., D.L.S., Whitehorse, Yukon,
1910—Dickson, Jas., D.L.S., Penelon Falls, Ont.
1912—Dillabough, J. U., D.L.S., St. Boniface, Man.
1909—Dodge, G. B., D.L.S., Interior Dept., Ottawa.
1913—Donnelly, Cecil, D.L.S., 343 Carlton St., Winnipeg, Man.
1907—Doupe, J. L., D.L.S., c/o C.P.R., Land Department, Winnipeg.
1910—Driscoll, A., D.L.S., Edmonton, Alta.
1910—Drummond, T., D.T.S., 119 St. Matthew St., Montreal.
1909—Ducker, W. A., D.L.S., 144 Smith St., Winnipeg.
1907—Dumais, P. T. C., D.L.S., Hull, P.Q.

1911—Earle, W. S., D.L.S., Picton, Ont.
1913—Edeskoly, Von J., D.L.S., 17 Inns. of Court Bldg., Vancouver, B.C.
1909—Edwards, Geo., D.L.S., Ponoka, Alta.
1910—Ellacot, C. H., D.L.S., Box 169, Victoria, B.C.
1907—Engler, C., D.L.S., Interior Dept., Ottawa.
1912—Evans, S. L., D.L.S., Corinth, Ont.

1910—Fairchild, C. C., D.L.S., 54 Brant Ave., Brantford, Ont.
1909—Farncomb, A. E., D.L.S., Lacombe, Alta.
1907—Fawcett, A., D.L.S., Edmonton, Alta.
1907—Fawcett, Thos., D.T.S., Boundary Surveys, Ottawa.
1910—Ferguson, G. H., D.L.S., Commission of Conservation, Ottawa.
1911—Fletcher, J. A., D.L.S., Interior Dept., Ottawa.
1907—Fontaine, L. E., D.L.S., Inspector of Surveys, Alberta Hotel, Edmonton.

Date of
Election. ACTIVE MEMBERS—*Continued.*

1911—Galletly, J. S., D.L.S., Peace River Crossing, Alta.
1909—Garner, A. C., D.L.S., Qu'Appelle, Sask.
1908—Gibbon, Jas., D.L.S., 1386 11th Ave. West, Vancouver, B.C.
1913—Glover, A. E., D.L.S., 140 Jasper Ave. West, Edmonton, Alta.
1907—Green, T. D., D.L.S., Rocky Mountain House, Alta.
1907—Grover, G. A., D.L.S., 24 King St. West, Toronto.
1910—Gordon, M. L., D.L.S., 619 Hastings St., Victoria, B.C.

1913—Hamilton, Chas. T., D.L.S., 1001 Rogers Bldg., Vancouver, B.C.
1911—Haggen, R. W., D.L.S., Revelstoke, B.C.
1913—Harris, J. W., D.L.S., City Engineer, Winnipeg, Man.
1910—Harvey, Chas., D.L.S., Kelowna, B.C.
1907—Hawkins, A. H., D.L.S., Wabasca, Alta.
1907—Heathcott, R. V., D.L.S., Edmonton, Alta.
1913—Hemperman, L. F., D.L.S., Phoenix, Ariz.
1907—Henderson, F. D., D.L.S., Interior Dept., Ottawa.
1911—Herriot, G. H., D.L.S., Souris, Man.
1911—Higgins, C. J., D.L.S., Box 986, Vancouver, B.C.
1912—Hobbs, W. E., D.L.S., Winnipeg, Man.
1907—Holcroft, H. S., D.L.S., 105 St. Vincent St., Toronto.
1907—Hopkins, M. W., D.L.S., Edmonton, Alta.
1907—Hubbell, E. W., D.L.S., Secretary, Chief Inspector of Surveys, 61 Russell Ave.,Ottawa
1912—Hunter, A. E., D.L.S., Wiarton, Ont.
1911—Inkster, O., D.L.S., Edmonton, Alta.
1909—Jephson, R. J., D.L.S., Box 986, Brandon, Man.
1909—Johnson, A. W., D.L.S., Kamloops, B.C.
1911—Johnston, W. J., D.L.S., 74 Exchange Building, 142 Hastings Street, Vancouver, B.C.
1913—Johnson, C. E., D.L.S., Toronto, Ont.
1912—Johnston, J. H., D.L.S., Peace River Crossing, Alta.
1912—Jones, G. S., D.L.S., Interior Department, Ottawa.

1907—Kimpe, M., D.L.S., Edmonton, Alta.
1907—Kirk, J. A., D.L.S., Summerland, B.C.
1911—Kitto, F. H., D.L.S., Director of Surveys, Dawson, Yukon.
1910—Knight, R. H., D.L.S., Edmonton, Alta.

1912—Latimer, F. H., D.L.S., Pentington, B.C.
1910—Lemoine, C. E., D.L.S., 111 Mountain Hill, Quebec, P.Q.
1911—Lighthall, A., D.L.S., 2328 Vine St., Vancouver, B.C.
1907—Lonergan, G. J., D.L.S., Inspector of Surveys, Buckingham, P.Q.
1912—Loucks, R. W. E., D.L.S., Delisle, Sask.
1907—Lumsden, H. D., D.L.S., 152 Argyle Ave., Ottawa.

1912—Martindale, E. S., D.L.S., Kings Mill, Ont.
1912—Martyn, O. W., D.L.S., Box 489, Regina, Sask.
1911—Matheson, H., D.L.S., Pocahontas, Alta.
1909—McArthur, J. J., D.L.S., Boundary Surveys, Ottawa.
1912—McCaw, R. D., D.L.S., Sidney, Vancouver Island, B.C.
1910—McColl, G. B., D.T.S., 178 Langside Ave., Winnipeg.
1912—McEwen, D. F., D.L.S., Grouard, Alta.
1910—McFadden, M., D.L.S., 1255 15th Ave. E., Vancouver, B.C.
1910—McFarlane, J. B., D.L.S., 60 Lonsdale Road, Toronto.

Date of
Election.

ACTIVE MEMBERS—*Continued.*

1908—McFarlane, W. G., D.L.S., 55 Elliot St., Toronto.
1908—McGrandle, H., D.L.S., Wetaskiwin, Alta.
1912—McKay, R. B., D.L.S., 1146 Pacific St., Vancouver, B.C.
1913—McNaughton, A. L., D.L.S., Cornwall, Ont.
1913—McElhanney, W. G., D.L.S., Vancouver, B.C.
1909—McLean, J. K., D.L.S., Indian Dept., Ottawa.
1907—McMillan, Geo., D.L.S., Finch, Ont.
1912—Melhuish, P., D.L.S., 2328 Vine St., Vancouver, B.C.
1913—Milliken, J. B., D.L.S., Dept. Interior, Ottawa.
1907—Miles, C. F., D.L.S., President, Inspector of Surveys, 25 Marmaduke St., Toronto.
1909—Moberly, H. K., D.L.S., Moosomin, Sask.
1909—Montgomery, R. H., D.L.S., Prince Albert, Sask.
1909—Morrier, J. E., D.L.S., Prince Albert, Sask.
1907—Mountain, G. A., D.L.S., Chief Engineer to the Railway Commission, Ottawa.

1911—Narraway, A. M., D.L.S., 197 Second Ave., Ottawa.
1907—Nash, T. S., D.L.S., Interior Dept., Ottawa.
1912—Neelands, R., D.L.S., Hamiota, Man.
1909—Nelles, D. H., D.L.S., Boundary Surveys, Ottawa.
1912—Neville, E. A., D.L.S., 936 Granville St., Vancouver, B.C.

1910—Ogilvie, N. J., D.L.S., Boundary Surveys, Ottawa.

1913—Parry, H., D.L.S., Interior Dept., Ottawa.
1912—Palmer, P. E., D.L.S., Dorchester, N.B.
1910—Parsons, J. L. R., D.L.S., Box 1004 Regina, Sask.
1910—Patrick, A. P., D.T.S., Calgary, Alta.
1910—Pearce, Wm., D.L.S., Calgary, Alta.
1913—Pearson, H. E., D.L.S., 42 Jasper Ave.West, Edmonton, Alta.
1907—Phillips, E. H., D.L.S., Saskatoon, Sask.
1911—Pierce, J. W., D.L.S., Room 43, Citizen Building, Ottawa.
1911—Plunkett, T. H., D.L.S., Whitehorn, Man.
1912—Powell, W. H., D.L.S., 420 Michigan St., Victoria, B.C.
1912—Ponton, A. W., D.L.S., Edmonton, Alta.
1911—Purser, R. C., D.L.S., 32 Glengarry Ave., Windsor, Ont.

1911—Rainboth, G. L., D.L.S., 186 Cooper St., Ottawa.
1911—Ransom, J. T., D.L.S., 470 Manning Ave., Toronto.
1911—Reid, F. B., D.L.S., Geodetic Surveys, Ottawa.
1910—Reiffenstein, J. H., D.L.S., Interior Dept., Ottawa.
1913—Reid, John, D.L.S., 161 Leonore St., Winnipeg, Man.
1907—Reilly, W. R., D.L.S., Regina, Sask.
1911—Rinfret, C., D.L.S., 26 Rue St. Jacques, Montreal.
1907—Rinfret, R., D.L.S., 97 St. James Street, Montreal.
1913—Robertson, D. F., D.L.S., Indian Affairs Dept., Ottawa.
1910—Robinson, E. W., D.L.S., Le Pas, Man.
1909—Rolfson, O., D.L.S., Box 378 Walkerville, Ont.
1907—Ross, Geo., D.L.S., Welland, Ont.
1910—Ross, J. E., D.L.S., Kamloops, B.C.
1907—Roy, G. P., D.L.S., 28 Lachevrotie St., Quebec.
1911—Roy, J. E., D.L.S., 28 Lachevrotie St., Quebec.

Date of
Election.

ACTIVE MEMBERS—*Continued.*

1908—Saint-Cyr, A., D.L.S., Box 1030, Prince Albert, Sask.
1907—Saint-Cyr, J. B., D.L.S., 1760 St. Urbian St., Montreal.
1909—Saunders, B. J., D.L.S., Edmonton, Alta.
1910—Scott, W. A., D.L.S., Saskatoon, Sask.
1909—Seager, E., D.L.S., Kenora, Ont.
1912—Segré, B. H., D.L.S., Toronto, Ont.
1912—Seibert, F. V., D.L.S., 609 Spadina Ave., Toronto.
1910—Seymour, H. L., D.L.S., Edmonton, Alta.
1907—Shanks, T., D.L.S., Chief Draughtsman, Topographical Surveys Branch, Interior Dept., Ottawa.
1912—Sheppard, H. C. T., D.L.S., Geological Survey, Ottawa.
1910—Shaw, C. A. E., D.L.S., Greenwood, B.C.
1912—Sirois, J. E., D.L.S., Box 26, Ste. Anne de la Pocatiere, Kamouraska, P.Q.
1908—Smith, C. C., D.L.S., Victoria, B.C.
1907—Speight, T. B., D.L.S., 703 Temple Building, Toronto.
1912—Soars, H. M. R., D.L.S., 637 First St., Edmonton, Alta.
1909—Steele, I. J., D.L.S., 18 Rideau Terrace, Rockliffe, Ottawa.
1912—Stewart, A. G., D.L.S., Hotel Cecil, Edmonton, Alta.
1912—Stewart, N. C., D.L.S., 936 Granville St., Vancouver, B.C.
1911—Stewart, W. M., D.L.S., Saskatoon, Sask.
1911—Stitt, O. M., D.L.S., 319 Pender St. W., Vancouver, B.C.
1911—Stuart, A. G., D.L.S., 150 Elgin St., Ottawa.
1911—Street, P. B., D.L.S., 17 Spadina Road, Toronto.

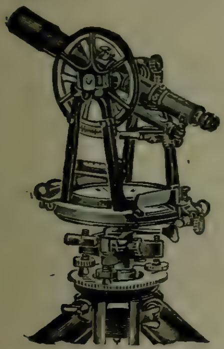
911—Taggart, C. H., D.L.S., 25 Patterson Ave., Ottawa.
1908—Teasdale, C. M., D.L.S., Concord, Ont.
1912—Tremblay, A. J., D.L.S., Box 1077, Edmonton, Alta.
1907—Tyrrell, J. W., D.L.S., 7 Hughson St., Hamilton, Ont.
1912—Tobey, W. M., D.T.S., Ottawa, Ont.

1911—Underwood, J. E., D.L.S., Saskatoon, Sask.
[illegible]

1913—Waddell, W. H., D.L.S., Edmonton, Alta.
1911—Walker, C. M., D.L.S., 24 Edward St., London, Ont.
1911—Wallace, J. N., D.L.S., Box 1774, Calgary, Alta.
1907—Watt, G. H., D.L.S., Interior Dept., Ottawa.
1913—Waugh, B. W., D.L.S., Interior Dept., Ottawa.
1907—Weekes, A. S., D.L.S., 540 Sutherland St., Edmonton, Alta.
1907—Weekes, M. B., D.L.S., Director of Surveys, Regina, Sask.
1910—Westland, C. R., D,L.S., Boundary Surveys, Ottawa.
1909—Wheeler, A. O., D.L.S., Calgary, Alta.
1912—Whitcher, A. H., D.L.S., Secretary, Geographic Board, Ottawa.
1912—White, W. R., D.L.S., Indian Affairs Dept., Ottawa.
1907—White-Fraser, G. M., D.T.S., Ottawa.
1912—Whyte, H. E., D.L.S., 926 North Park St., Victoria, B.C.
1910—Woods, J. E., D.L.S., Pincher Creek, Alta.
1912—Wright, A. E., D.L.S., Box 70, Prince Rupert, B.C.

1909—Young, W. H., D.L.S., Lethbridge, Alta.

Date of Election.	DECEASED MEMBERS.	DECEASED.
1908	Green, W. T., D.L.S.	November 1st, 1909.
1909	Rainboth, G. C., D.L.S.	1910.
1908	Ratz, W. F., D.L.S.	January, 1909.
1907	Reid, J. L., D.L.S.	June, 1901.
1907	Selby, H. W., D.L.S.	August, 23rd 1910.
1907	Stacey, A. G., D.L.S.	June 4th, 1908.
1907	Young, R. E., D.L.S.	October 24th, 1911.
1910	Mackie, F. H. D.L.S.	December 23rd, 1912.
1912	Ogilvie, Wm., D.L.S.	November 13th, 1912.



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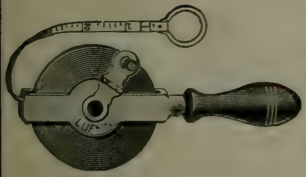

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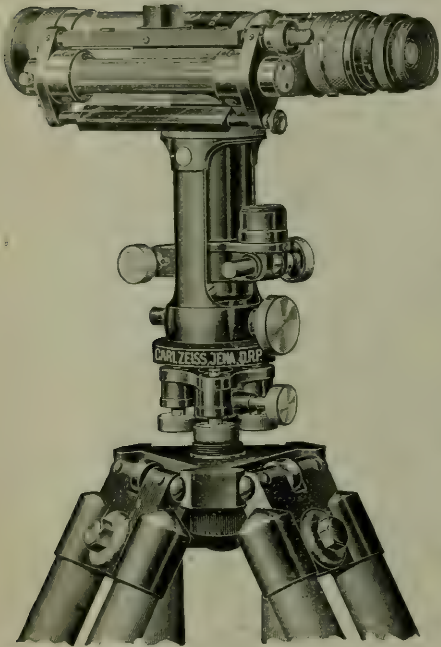

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ANNUAL REPORT

OF TPE

Association of Dominion Land Surveyors

Eighth Annual Meeting

HELD AT

OTTAWA

on the 3rd and 4th of March, 1914.

◆

OTTAWA
R. J. Taylor, Printer, Queen Street.

1914.

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E. DEVILLE, LL.D., D.T.S., Honorary Patron.

E. DEVILLE, LL.D., D.T.S., SURVEYOR-GENERAL.

Edouard Gaston Deville, born in La Charite sur Loire, Nièure, France, in 1849 ; he was educated at the French Naval School, the old three decker "Borda," at Brest, from which he graduated in 1868. He served in the French Navy for several years and had charge of extensive hydrographic surveys in the islands of the Pacific Ocean, Peru and elsewhwre. He retired from the navy in 1874, came to Canada and soon after his arrival entered the service of the Quebec Government as scientific explorer, remaining there until 1879 as Inspector of Surveys and Astronomer. He was commissioned as Provincial Land Surveyor in 1877, and as Dominion Land and Topographical Surveyor in 1878. In 1881, he became Inspector of Dominion Land Surveys,—Chief Inspector in 1882, and in 1885 was appointed Surveyor General of Canada. He is Chairman of the Board of Examiners for Dominion Land Surveyors, and a charter member of the Royal Society of Canada, being for over twenty years Secretary of the Scientific Section. He has been a Governor of St. Luke's Hospital, since its establishment in 1898, and is Secretary of its Executive Committee. In 1905, the University of Toronto conferred on him the degree of Doctor of Laws (LL.D.) He is the author of "Astronomic and Geodetic Calculations," "Photographic Surveying," and numerous scientific and professional papers, Ottawa. Nearly the whole of the land survey of Western Canada has been executed under his direction.

C. F. AYLSWORTH, D.L.S., President.

CHARLES FRASER AYLSWORTH

Charles Fraser Aylsworth was born in the City of Belleville, Ontario, on the 21st April, 1862. His father was an Ontario Land Surveyor and occupied the position of Inspector of Colonization roads for the Province of Ontario for a period extending over thirty years.

In 1862 the family moved to Madoc, Ontario, where the father practised surveying for a few years, then he purchased a farm, having in the meantime been appointed to construct colonization roads at which he continued for a few years, when he was promoted to Inspector of Colonization Roads, resigning in 1903 on account of ill-health.

The subject of this sketch lived on a farm and attended the Madoc Public School until the year 1880. He attributes his success with some branches of surveying to his experience gained while living on the farm. The experience thus gained was advantageous and indispensible with the transport outfit. He attended Albert College from 1880 to 1883, after which, having passed the preliminary examination for a P. L. S., he became articled to P. S. Gibson, Provincial Land Surveyor for Ontario, and in January, 1886, was granted a license to practice as a Provincial Land Surveyor,—and in May of the same year, having passed the necessary examination, became a Dominion Land Surveyor.

Further in the same year he assisted the late Surveyor, Alexander Niven, to block out five townships along the north end of Lake Temiscamingue, in which have since grown up the now famous towns of New Liskeard and Haileybury.

He then practised local surveying in Hastings and adjoining counties until 1897, having been appointed Engineer under the Ontario Ditches and Water Courses Act, for many townships. These were lean years for the Surveyors, so in order to keep out of mischief during those lean years, he participated in municipal affairs and was rewarded by being elected to the highest position at the gift of his fellow townsmen. In 1897 he was appointed to Dominion Land Survey work, at which he continued principally on re-surveys and correction surveys until the present time. He is of United Empire Loyalist descent.

Association of Dominion Land Surveyors.

OFFICERS FOR 1914-1915.

Patron:

E. DEVILLE, LL.D., D.T.S., Surveyor-General.

Honorary President:

W. F. KING, C.M.G., LL.D., D.T.S.

President:

C. F. AYLSWORTH, D.L.S., O.L.S.

Vice-President:

A. H. HAWKINS, D.L.S.

Second Vice-Presidents:

G. B. DODGE, D.L.S., Ontario.
P. T. C. DUMAIS, D.L.S., Quebec.
W. J. DEANS, D.L.S., Manitoba.
R. H. MONTGOMERY, D.L.S., Saskatchewan.
R. W. CAUTLEY, D.L.S., Alberta.
W. G. MCELHANNEY, D.L.S., British Columbia.
F. H. KITTO, D.L.S., Yukon and N.W. Territory.
P. E. PALMER, D.L.S., New Brunswick.

Executive Committee:

E. M. DENNIS, D.L.S.
D. F. ROBERTSON, D.L.S.
D. H. NELLES, D.L.S.

Secretary-Treasurer:

E. W. HUBBELL, D.L.S.

CONSTITUTION.

ARTICLE I.

Name of the Association.

"The Association of Dominion Land Surveyors."

ARTICLE II.

Objects of the Association.

The promotion of the general interests and the elevation of the standard of the profession.

ARTICLE III.

Members.

1. The Association shall consist of Active Members and Honorary Members.

2. Active members must be Dominion Land Surveyors, and only such shall hold office.

3. Any Dominion Land Surveyor may become an Active Member upon payment of the fees prescribed by Article IX.

4. Honorary Members must be nominated by two Active Members, and the nomination approved of by a unanimous vote of the Executive Committee. The nomination, with approval, must be in the hands of the Secretary-Treasurer at least one month before the Annual Meeting. They shall be elected by ballot in the manner hereinafter provided for the election of officers of the Association. The number of Honorary Members shall not, at any one time, exceed ten, and they shall be exempt from payment of dues.

ARTICLE IV.

1. The Surveyor General of Dominion Lands shall be Patron of the Association.

2. The officers of the Association shall consist of an Honorary President, a President, a Vice-President, a 2nd Vice-President from each Province, a Secretary-Treasurer, and an Executive Committee, all of whom shall be nominated at the General Annual Meeting,

excepting the 2nd Vice-Presidents for the Provinces, whom shall be elected separately by each Province. The ballots to be sent members by the Secretary-Treasurer.

3. Voting for officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all members on or before the 20th day of January, in each year.

4. The ballots are to be returned to the Secretary-Treasurer on or before the 20th day of March, in each year, to be opened and counted by him.

5. Candidates and retiring officers are to be notified by the Secretary-Treasurer of the result of the election.

6. The Secretary-Treasurer is to have a vote only in the case of a tie.

ARTICLE V.

MEETINGS.

1. The Annual General Meeting shall commence on the last Wednesday in January, at Ottawa.

2. Special meetings of the Association may be called by the President, or by the President when requested in writing by three or more members.

3. Nine members shall form a quorum at any meeting for the transaction of business.

ARTICLE VI.

Any member of the Association who may desire a change in the Constitution of the Association, shall give notice of such contemplated change to the Secretary-Treasurer, at least one month before the next Annual Meeting, and the Secretary-Treasurer shall, in his notice of such meeting to the members, notify them of the name of the party proposing such change, and the nature thereof.

No by-law or rule shall be altered, or new one adopted, except at a General Meeting, and such amendment shall be voted upon at the said General Meeting, two-thirds majority of the votes cast being necessary for its adoption.

ARTICLE VII.

EXECUTIVE COMMITTEE.

1. The Executive Committee shall consist of the President, Vice-President, Secretary-Treasurer, and three members, and shall have the direction and management of the affairs of the Association. Three members shall form a quorum.

2. The meetings of the Executive Committee to be held at the call of the President or Secretary-Treasurer.

ARTICLE VIII.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same at the Annual General Meeting.

ARTICLE IX.

SUBSCRIPTIONS.

1. The fee for membership for Active Members shall be two dollars, payable in advance.

2. The fees of Active Members shall be forwarded to the Secretary-Treasurer with the ballot paper for election of officers, and any ballot unaccompanied by the fees mentioned in sub-clause No. 1, in case the said fee has not previously been paid, shall not be counted in the election.

BY-LAWS.

ORDER OF BUSINESS.

1. Reading of Minutes of previous meeting.
2. Reading of correspondence and accounts.
3. Nominations for Honorary Membership.
4. Balloting for Honorary Membership.
5. Reports.
6. Unfinished Business.
7. New Business.
8. Nomination of Officers.
9. Adjournment.

2. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

3. Reports of Committees must be in writing, signed by the Chairman thereof.

4. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself, subject to the discretion of the Chair.

5. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed.

6. The Chairman shall appoint two scrutineers when a ballot is taken.

7. Every member, while speaking, shall address the Chair.

8. Parliamentary Rules to govern in all cases not provided for in preceding sections.

DUTIES OF OFFICERS.

1. The President shall preside at all meetings at which he is present; in his absence, the Vice-President; and in the absence of both, the meeting shall appoint a Chairman.

2. The presiding officer shall only have a casting vote, not a deliberate one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

Association of Dominion Land Surveyors

EIGHTH ANNUAL MEETING.

OTTAWA, TUESDAY, MARCH 3RD, 1914.

The Eighth Annual Meeting of the Association of Dominion Land Surveyors opened this morning in the Carnegie Library at 10 o'clock.

Members present at one or more meeting: Messrs. J. J. McArthur (in the chair); J. R. Akins, C. F. Aylsworth, G. A. Bennett, G. H. Blanchet, T. E. Brown, T. Barton, E. P. Bowman, P. M. Coté, J. D. Craig, P. W. Currie, G. C. Cowper, G. W. Coltham, M. F. Cochrane, H. W. Cannell, T. H. G. Clunn, Dr. Deville, E. M. Dennis, M. Daly, G. B. Dodge, A. Elder, C. Engler, S. L. Evans, J. A. Fletcher, L. E. Fontaine, A. Fraser, B. Gray, E. W. Hubbell, A. W. Hawkins, G. H. Herriott, F. D. Henderson, G. S. Jones, Dr. King, J. A. S. King, Dr. Klotz, P. M. H. LeBlanc, G. J. Lonergan, J. McCusker, C. McDonald, Geo. Morency, J. P. Milliken, H. Mathewson, J. C. Mitchell, Geo. Mountain, T. S. Nash, R. Neelands, N. Ogilvie, A. M. Narraway, A. M. Perry, C. Rinfret, G. P. Roy, D. F. Robertson, L. V. Rorke, G. Rainboth, F. Steers, T. B. Speight, A. G. Stewart, P. B. Symes, T. Shanks, A. C. T. Sheppard, J. J. Stock, C. Teasdale, W. M. Tobey, Geo. Watt, E. E. D. Wilson, C. Westland, E. J. Wight, and others.

The meeting being called to order, Secretary Hubbell said:

Gentlemen, this meeting having been called to-day for ten o'clock, I am sorry to see that some members are a little dilatory in not being here on time. We have a lot of business to transact, and some excellent papers to read, which all Surveyors, especially those interested in Transportation on Base Lines, should find instructive. In the absence of our President, Mr. Miles, at present in the Athabaska district, surveying, and our Vice-President, Mr. Aylsworth, I suggest that we nominate Mr. J. J. McArthur, D.L.S., Assistant Boundary Commissioner, Chairman, and make a motion to that effect.

MR. ROBERTSON: I second that motion.

Motion unanimously carried.

In taking the chair, Mr. McArthur said:—

Gentlemen, I feel much honoured in being asked to replace Mr. Miles, for the present session. The first item on the programme is the reading of the minutes of the last meeting. I do not remember that there was anything of a controversial nature in the proceedings at the last session, and if some one move that we take the minutes as read, it will facilitate matters materially.

SECRETARY HUBBELL: The minutes of the last Annual Meeting are embodied in the Annual Report, and if there is no objection, they can be approved of as published.

On motion this was adopted.

CORRESPONDENCE.

SECRETARY HUBBELL: Many letters have been received in connection with correspondence of the Association during the past year, and I think the majority are not of sufficient importance to take up the time of this meeting. Amongst the number were a few criticising some of the statements made by Surveyors, at the last meeting. Our Reporter was an employee of the House of Commons, and during the celebrated "dead lock" on the Naval Question, which kept the House in Session continuously the week of our meeting, he could not attend our meetings regularly, and we were unable to obtain a substitute, so we did the best possible under the circumstances. It is to be regretted, that surveyors have but little opportunity to revise their reports and statements. It is to be hoped that this year, there will be no mis-quotations of surveyors remarks in the Annual Report.

In conformity with a resolution proposed by Mr. Wallace, D.L.S., and seconded by myself last year (an amendment to the Constitution). The Second Vice-Presidents of the various Provinces were elected by ballot, by members of the different provinces.

The Executive Committee suggested five names of desirable members to choose from. Very little enthusiasm was shown by the various members; in fact a state of apathy existed, which was rather disconcerting.

The result of the election demonstrated that very little interest was taken by members of the Association in the Western Provinces, and perhaps as matters now exist, it is hardly to be expected. I wrote the different Vice-Presidents requesting them to contribute papers to be read at our Annual Meeting, some replied; others did not. For example, here is a letter from Mr. Phillips, Vice-President for Saskatchewan, asking Mr. Garner of Regina, to contribute a paper and his reply thereto.

Saskatoon, Sask.,
Feb. 2nd, 1914.

E. W. Hubbell, Esq.,
Sec'y., D.L.S. Assn., Ottawa.

Sir:—

I am in receipt of your letter of the 23rd January, with reference to the Annual Meeting of the Dominion Land Surveyors Association.

I have communicated with all the Dominion Land Surveyors I know of in the Province, some 19 or 20, and will inform you as to results of my inquiries before the Annual Meeting. I have asked for information as set out in paragraphs 1 and 2 of your letter to me. As to paragraph 3, I may mention the names of:

W. M. Stewart, D.L.S., Saskatoon.
R. H. Montgomery, Prince Albert.
W. R. Reilly, Regina.

These surveyors have all been engaged in D. L. S. work in this Province within the last few years, and are far better able to represent the Province than some of the rest of us who have been engaged entirely on Provincial work. I must confess that I have gotten pretty much out of touch with Dominion work, and feel that I cannot do justice to the position of Second Vice-President.

Yours truly,
E. H. Phillips.

Saskatoon, Sask.,
Feb. 18th, 1914.

E. W. Hubbell, D.L.S.,
Sec'y., D.L.S. Assn., Ottawa, Ont.

Sir:—

I wrote you about the first of the present month and informed you that I had communicated with all of the Dominion Land Surveyors of whom I knew in the Province. I have had only five replies and four of these were to the effect that they knew of no subject they would like to have discussed.

I am enclosing herewith copy of letter received from A. C. Garner, Chief Surveyor of the Land Titles Office, Regina, in which he refers to several questions in a former letter written to the Association and which he would like to have discussed further.

It is a difficult matter to arouse any enthusiasm among the Dominion Land Surveyors of Saskatchewan, regarding the Annual Meeting. This should not be, but there is no getting away from the fact, as evidenced by the very small number of Dominion Land Surveyors who have even taken the trouble to acknowledge the receipt of my communication. There are several reasons why this state of affairs exists:

(1) There are very few resident D. L. S. men in the province who are engaged on Dominion Lands Surveys.

(2) Surveyors, except those in the same city, very seldom meet and if they do, it is not in connection with Dominion Lands Surveys.

(3) The Dominion Land Surveyors are nearly all Provincial Land Surveyors, and we have difficulty in keeping pace with the legislation affecting our more immediate interests.

(4) We have a very live Association of Provincial Land Surveyors, and our assistance in the way of contributing papers, etc., is urgently demanded and more freely given on subjects affecting our every day work.

(5) From the annual reports of the Dominion Land Surveyors Association we feel that the Association is somewhat antagonistic towards us.

These few criticisms are not given in a complaining way, but with the hope that they may possibly explain the attitude of some of our surveyors towards the Dominion Land Surveyors' Association.

As one of the officials of the first meeting of the Association, and as Second Vice-President for Saskatchewan, I hope you may have a very successful and useful Annual Meeting.

Yours truly,
E. H. PHILLIPS.

REGINA, FEB. 15TH, 1914.

DEAR SIR:—

Kindly accept thanks for your letter of the 2nd inst., and also accept my apologies for not attending to same at an earlier date. My real excuse being that in the meantime, I have been considering whether I had sufficient time at my disposal to write a paper of interest for your Association. I find, however, that with the approach of the Annual Meeting of Saskatchewan Land Surveyors, and other work which I have in hand, that there is not sufficient time to prepare a paper. Your request that I should write, is, however, very much appreciated.

Regarding views which I should like discussed, again I have not had time to carefully consider points which I should like taken up, sufficiently to place same in concrete form. I would, however, refer you to Annual Report, 1912, which contains a letter written by me to the Association, raising a number of questions. Some of the questions asked appear to have been dealt with. I should like to see questions 1, 2, and 3 further discussed.

Although comparatively few Dominion Land Surveyors are practicing under their commissions, that is, the majority are practicing under Provincial commissions, every one holding a D.L.S. commission is interested as to the status, value and prospective future under the commission, and although as members of a profession it is our duty to assist and raise the standard of the profession, and that the respective Associations should work in harmony with one another along these lines, it is also equally necessary that each Association should take a proper interest and carefully safeguard their respective interests, and while possibly few Dominion Land Surveyors expect to practice under their commissions, I think that they are anxious that their commissions should be safeguarded, that is, what is the prospective future for a Dominion Land Surveyor? Also the Association, considering it is the first and oldest, should have a better standing and much greater support than it has, by Dominion Land Surveyors. I would also refer you to Annual Report of 1913; in the main, I think this Report strikes at the keynote, or rather lack of success, which the Association has. A great deal of the report goes into salaries, and what should be paid on contract work, etc. I do not think the Annual Meeting the time or place to discuss such matters, except in a passing or brief manner; these questions only apply to the few employed under their commissions, and does not reach or appeal to all Dominion Land Surveyors, which should be the object aimed at. They are questions which ought to be dealt with by the respective Departments and the persons interested, and not by a body, except in the manner above noted.

As you are aware, in the Saskatchewan Land Surveyors' Association, the Association will have nothing whatever to do with the tariff of fees, as the Association does not consider that that is a question to be dealt with by the Association.

I do not know whether I have made myself clear, and if not would prefer that you should not bring my views before your Association. What I have endeavoured to point out is, that every Dominion Land Surveyor should be a member of the Dominion Land Surveyors' Association, and his interest roused in support of the Association. It should not go so far, however, as to conflict with any other commission which a surveyor holds, that is. each separate commission should be considered under its merits and safe-guarded.

The Dominion Land Surveyors' Association at present appears to take an antagonistic stand towards Provincial Associations, and I fail to see that they have any grounds, as yet, for such an attitude, if the Provincial Associations have narrowed the scope of work for members of the Dominion Land Surveyors' Association, it is because the Provincial Associations have taken a keen interest and have carefully safeguarded their interests. I think I can also safely point out that they are working very hard in their respective interests, in an honest endeavour to raise the standard of the profession all the way through; also in all the reports of the Provincial Associations that I have had access to of recent years, I find very little, and in many cases, no discussions as to Fees, Salaries, Rates, etc.

Trusting you will excuse this lengthy letter, and with kind regards, believe me,

Yours sincerely,
(Sgd.) A. C. Garner.

E. H. Phillips, Esq., D.L.S.,
Vice-President, D.L.S. Assn.,
c|o Phillips, Stewart & Lee, Saskatoon, Sask.

The Chairman: Are there any remarks on the communication of Mr. Garner?

Secretary Hubbell: In reference to the question raised by Mr. Garner, in connection with the discussion of salaries and fees, by our Association, it should be noted, that as our Association is not an incorporated body, the decision with regard to salaries, fees, etc., etc., does not rest with us, thereby differing in this respect from Provincial Associations. In my opinion, our Association is quite justified, at the Annual Meetings, in discussing the financial status of Surveyors, and do all in its power to substantiate and further just claims for their advancement in this respect.

CHAIRMAN'S ADDRESS.

MR. McARTHUR, on rising to address the meeting, was received with applause.

He said: Our President, Mr. C. F. Miles, is still in Northern Alberta, and I am deeply sensible of the honour your Committee has done in asking me to preside in his absence. Mr. Miles has attained the advanced age of 73, and he still spends at least three-quarters of each year in the field. He is a man of remarkable vigour, both mentally and physically, We hope to find him amongst us again, safe and sound.

Our Secretary has just reminded me that there is another hardy old pioneer still to the fore, Mr. Moses McFadden, who took up residence in the West in 1871. His son John and I were two of the only six white boys in Fort Garry during the Winter 1872-73, and I think we must attribute the remarkable vigour of these old surveyors to the plain living and high thinking which are to be found nowhere, in such a marked degree, as in the camp of a surveyor.

It is our duty to record the death of two of our members, Mr. Johnston and J. K. McLean; the first mentioned was a bright young man, before whom life was opening as a bright vista, which death suddenly obscured. J. K. McLean had passed the half century mark, and his career as a surveyor had been long and creditable. He was my partner in the rush of 1882, and I found him to be an estimable colleague, able and conscientious. It will be in order for some member to move a resolution of sympathy, which our Secretary will have forwarded to their respective families.

Our Secretary reports favourable on our memberdhip and finances. He will give you the particulars shortly.

To practising surveyors, the most important event of the year is the issue of the new Manual. It shows the highly scientific character of the work demanded, even upon sub-division surveys, and the great precautions taken to ensure the permanency of corner monuments, which in importance is almost second to none in the work of the Surveyor.

Long ago, the Department did not realize the importance of accurate surveys. In the early eighties, we worked under general instructions which impressed upon the surveyor that "It was not extreme accuracy that was required, but despatch of work." It developed into a surveying match between twenty or forty parties, as to which would return the greatest mileage, with the inevitable result that some of us took all the latitude which the instructions allowed, and some of the work done was not very creditable.

Very little knowledge comes to man by intuition. He must learn by experience, and it came home to the Department that the value of surveys bears some relation to the cost; that it pays to do good work. This fact Dr. Deville realized over a quarter of a century ago, and during these long years he has worked untiringly to raise the standard of our surveying operations and perfect the organization of Dominion land surveys. Dr. Deville is to be complimented on the Manual. I took occasion to place the former edition in the hands of some of my colleagues, members of the Geodetic and Geological Surveys of the United States. The construction and use of the tables, prepared by Dr. Deville and Dr. King, impressed them very much; they had no idea that we had such a scientific, and, at the same time, so practical a system. This little volume is a credit to Canada. It shows that we are doing things worth while, that we have a sense of our responsibilities, that as our work is the base upon which future civilization must rest, we are striving to make that base permanent and accurate.

Last year we had a most successful meeting. Mr. Aylsworth, with his great persuasive powers, was able to get the young men to take an active part in the discussions. They contributed a most interesting exchange of experiences and opinions, and proved that they had given study and thought to all the questions which affect the profession.

Now we want you young men to keep it up. After all, the future of this Association and of the profession are in the hands of the young men, and we expect you to take hold.

I hope that this meeting will see fit to elect a young man to the Vice-Presidency, who will, in a year or two at the most, succeed to the Presidency, and we can thus inaugurate a regime of young officers who will take an ever growing interest in the increase and prosperity of our Association. (Applause.)

RESOLUTIONS OF SYMPATHY.

In conformity with the request of the Chairman, a motion was made and unanimously carried, that the Secretary be requested to send Resolutions of Sympathy to the family of the late J. K. McLean and Mr. Johnston, in the loss that they had sustained by the death of those two gentlemen.

SECRETARY-TREASURER'S REPORT.

Secretary-Treasurer Hubbell then presented his report for the year, which is as follows:—

MR. CHAIRMAN:

Having been appointed Secretary-Treasurer at the last Annual Meeting of the Association, I have the honour to lay before you the report of the business of the Association transacted between the 4th of March, 1913, and the 3rd March, 1914.

After revising the minutes of the last Annual Meeting, I compiled the different information, and placed the matter in the hands of R. J. Taylor, Book and Job Printer, Ottawa, for publication.

Six hundred and fifty (650) copies were printed.

Copies of the annual report were mailed, as far as possible, to the address of all members, besides those on the following list:—

Ontario Land Surveyors	150	copies.
Advertisers	12	"
Surveyors who received commission in 1913	25	"
Various persons	10	"
Reports of 1912	50	"

We received from the Ontario Land Surveyors' Association, 150 copies in exchange for an equal number of our report. Most of these were distributed to members of our Association, who are not members of the Ontario Land Surveyors' Association.

Our thanks are due to the following Surveyors' Associations and Societies from which we have received copies of their annual reports, by-laws and constitution:—

Ontario Land Surveyors' Association.
Alberta Land Surveyors' Association.
Saskatchewan Land Surveyors' Association.
Quebec Land Surveyors' Association.
British Columbia Land Surveyors' Association.
Iowa Engineers' and Surveyors' Society.
Commission of Conservation.

Last year, 125 letters were received and 215 sent out, apart from 24 letters to advertisers, 120 notices re arrears in fees, and 228 ballots in connection with the election of Second Vice-Presidents for each of the Provinces.

The official report of members has been revised from time to time, as changes occur, and now tabulates as follows:—

Hon. Members	9
Active Members	233

During the year the names of two members have been added to the deceased list: Messrs, J. K. McLean and C. E. Johnston; three have resigned: Messrs. White-Fraser, R. Rinfret, and James Dickson; and twenty-five newly licensed men have been added to the active list.

The financial statement herewith shows the various business transacted during the past year, and the present condition of the Association finances.

Statements of receipts, expenditures and balance between the 4th March, 1913, and the 3rd March, 1914.

FINANCIAL REPORT.

RECEIPTS.

March 5th. 1913, balance on hand	$459 84	
Advertisements in report	59 00	
Dinner tickets sold, 35 at $2.00	70 00	
Annual fees, 1910 and 1911	44 00	
Annual fees, 1912	96 00	
Annual fees, 1913	264 00	
Annual fees, 1914 to 1916	52 00	
Government grant	125 00	
Excess Commission on cheques	2 70	
Interest	12 76	
		$1,185 30

EXPENSES.

Lantern and attendant at last Annual Meeting	8 00	
Entertainment and Music at Annual Dinner	12 00	
Services of Stenographer	75 00	
Chateau Laurier, dinner bill for 1912-1913	109 30	
Grant to Secretary, 1912-1913	50 00	
Printing report and circulars	191 75	
Commission on cheques	4 50	
Advertisements in Ottawa papers	3 00	
Postage and small items	13 80	
Amount on deposit in Quebec Bank	717 95	
		$1,185 30

Audited and found correct.

(Sgd.) E. M. DENNIS.
H. W. CANNELL, *Auditors.*

Ottawa, 28th February, 1914.

It will be noticed that there is a slight discrepancy in the account audited $443.10, and in the amount received $459.84. This is accounted for as follows; after the retiring Secretary-Treasurer had transferred the accounts of the Association to me, fees amounting to $26.74 were received by him and deposited to our credit in the Quebec Bank.

Now gentlemen, I think our financial report is most satisfactory and encouraging. To give an idea of the progress and growth of our finances, I submit herewith a synopsis of receipts and expenditure for the past eight years.

Year.	Receipts.	Expenditure.	Balance.
1907	$ 69 64	$ 30 09	$ 39 55
1908	86 66	18 95	76 71
1909	250 42	58 60	191 82
1910	544 63	144 20	400 43
1911	743 04	242 25	500 79
1912	1,000 77	540 93	459 84
1913	1,185 30	467 35	717 95

THE CHAIRMAN: Gentlemen, I must say our Secretary reports a very satisfactory state of affairs in every way, and he is to be greatly complimented on the way he has attended to his part of the business. Will somebody move the adoption of the Secretary-Treasurer's report?

On motion, duly made and seconded, the report was thereupon adopted.

SECRETARY-TREASURER HUBBELL: The account book, in connection with our Association, has been audited by Mr. Dennis and Mr. Cannell, and shows a balance to our credit on the 28th of February, 1914, of $717.95. (The book was thereupon initialed by the Chairman of the Association).

NOMINATION FOR HONORARY MEMBERSHIP.

THE CHAIRMAN: Are there any honorary members to be proposed?

SECRETARY HUBBELL: No, there are no names submitted for Honorary Membership this year.

UNFINISHED BUSINESS.

THE CHAIRMAN: I would like to ask the Surveyors if they have any remarks to make on the new Manual, as it is issued. I am very sorry we have not Mr. Aylesworth here to start you going.

SECRETARY HUBBELL: If there is no other particular business this morning, we might have Mr. Brownlee's paper on "Arctic and Antarctic Explorations" read.

THE CHAIRMAN: Then I will ask the Secretary to read the paper by Mr. Brownlee.

SECRETARY HUBBELL: I have a couple of letters from Mr. Brownlee, which I might read before submitting his paper. Mr. Brownlee is Vice-President of our Association for British Columbia, and has kindly given us this paper. His letters are as follows:—

VANCOUVER, B.C.,
25TH FEB., 1914.

MAJOR E. W. HUBBELL,
Secretary, Assn. of D. L. S., Ottawa.

DEAR MAJOR HUBBELL:—

I am sorry I could not give more time to writing a paper for the Association meeting. I enclose herewith a letter, more in the nature of an apology, which I will be obliged if you will read, or have read for me. This at the same time gives a resume of the subject, and if the matter is of sufficient interest, I will be glad to follow it up next year, when I hope to have more time at my disposal.

I enclose $2.00, my 1914 subscription to the Association, with my best wishes for its future.

Thanking you for your many courtesies,

I am,
Yours very truly,
J. H. BROWNLEE.

VANCOUVER, B.C.,
24TH FEB., 1914.

MAJOR E. W. HUBBELL,
Secretary, Assn. of D. L. S., Ottawa.

MY DEAR MAJOR HUBBELL:—

In answer to your circular letter of 23rd January, paragraph 3. My first choice to succeed me as Second Vice-President for British Columbia, was my esteemed friend, James Brady, D.L.S., of Golden, but he has declined, thinking a younger man would better fill the office.

My second choice was W. G. McElhanney, D.L.S., of Vancouver, whom I have consulted and will accept. Either A. W. Johnston, of Kamloops, or F. C. Clements, of Prince Rupert, would be good men to succeed McElhanney, or to be elected, so I have advised them of their nomination. This fulfils the regulations.

I think on the whole, that this arrangement for the annual election of Vice-President is very satisfactory, provided the retiring Vice-President is conscientious in the selection of candidates.

Thanking you and the Board for the honour shewn me in selecting me as Second Vice-President for 1913-1914,

I am,
Yours sincerely,

J. H. Brownlee.

ARCTIC AND ANTARCTIC EXPLORATIONS.

The Members of the Dominion Land Surveyors Association.

Gentlemen:—

I had intended writing a paper on the "Future of Arctic versus Antarctic Explorations," to be read before the Association, but I much regret that pressure of other matters has prevented my doing so, so that I can only touch the fringe of the subject in the briefest possible way. I might also add that a dearth of reliable information to date, relative to Mawson's and other recent South Pole Expeditions, has been a drawback.

I take it, however, that the future of the North Polar Expeditions is much brighter and more to be encouraged than South Polar Land Work, and the former should be of greater interest to young Dominion Land Surveyors.

In June last, when Stefansson outfitted at Esquimalt, I tried to arouse the interest of our young Surveyors out here in the work of his party, but without success.

I am not much of a man worshipper or hero worshipper, but I have a great admiration for Captain Bartlett of the Karluk, who navigated Peary to within 200 miles of the North Pole, and I agree with Stefansson that Bartlett will come out of the ice jam O. K.

Now it is fairly well known that in the Antarctic, anywhere south of Latitude 60, you not only may encounter icebergs, but, as defined by such an eminent authority as Dr. W. S. Bruce, (the well-known Antarctic Explorer), you are actually in the Arctic Regions.

We all know that climatic conditions in the North are entirely more favorable. The discoveries of the Poles have been well done by Peary in the North and Amundsen and Scott in the South. While I do not wish to disparage such a land expedition as Shackleton proposes to encounter from Waddel Sea on one side across the barren Antarctic Continent, a distance of 1,700 miles, to Ross Bay on the other side, and by way of the South Pole, I really think the risk of lives and hardships to be met are greater than the results to be obtained.

This great South Antarctic Continent, is a barren mountainous waste, devoid of animal or bird life, and, as far as is known, to any vegetable sustenance such as "Tripe de roche" so well known in the North, where animal life abounds for both food, clothing and footwear.

As early as 1819 and 1820, Captain John Franklin (afterwards Sir John), made a successful trip from York Factory on Hudson's Bay to the mouth of Copper Mine River on the Arctic, including considerable Arctic Coast survey eastward of Cape Barrow, a total round journey of more than 5,500 miles, by river and lake, in canoes and over land portage. During most of the journey, and in those primitive days, Capt. Franklin lived off the country, a thing impossible on the unhospitable Antarctic Continent. Dr. Anderson and Stefansson are said to have lived with the Esquimos on the products of the country for nearly four years, on their expedition a few years ago.

The wealth of our North land region is a great incentive to continue Northern exploration work, and I have no doubt that the discovery of copper and other minerals is an inducement for the Federal Government to continue the services of such men as Stefansson, Dr. Anderson, and others, in these regions.

We know that coal and other minerals in the interior of Alaska are the principal inducements for the United States Government to authorize the expenditure of $35,000,000 for railways in the interior of that great country, to reach as far North as Fairbanks Gold Fields in Latitude 65 odd, and less than two degrees South of the Artic Circle. We are building a railway to Hudson's Bay, something that was considered impracticable only a few years back. Our vast and rich territories lying between Alaska and Hudson's Bay, including the Yukon and North of British Columbia, Alberta, Saskatchewan, Manitoba and Ontario, and also North of Quebec, are all deserving of greater attention by ambitious young Canadians, and surveyors in particular.

It appears to me that the greatest benefit to be derived from further Antarctic exploration will continue to result from further navigation and study of the causes of the climatic conditions that affect the South Continent, and some of the remedies. Dr. Bruce advocates more meteorology, oceanology, and aceaopanophy in the South Seas.

(Note.—See Dr. Bruce's book, "The Polar Regions," issued by Wm. Briggs, Toronto. Price, 35 cents).

In the North American Continent, "New Canada," and Alaska, we have vast unexplored areas that deserve scientific exploration and better mapping. I believe also, that similar conditions and opportunities prevail in Siberia. There is, therefore, a great open field for young surveyors of an astronomical, geological, topographical and cartographical turn of mind. I shall be pleased to hear from any young surveyors who have a bent in this direction.

Finally, it strikes me very forcibly that conditions in the Sub-Arctic regions are quite the reverse of what prevail in the Sub-Antarctic, and because nature has provided more bountifully for the extreme North than for the extreme South, we hardy Canadians should press on to make the best use of our heritage.

Yours for extending the knowledge of this great land.

J. H. Brownlee,
Con. Mem. Am. Geo. Society,
Member National Geo. Society.

Secretary Hubbell: I may say, there are a few alterations to the printed programme of the proceedings, caused by papers being received after arrangements had been completed for this meeting. However, we will try, and, if possible have them all read during the session.

The papers on "Transportation" have been arranged in consecutive order.

This afternoon, there will be a lecture by Dr. Otto Klotz, on the "Seismograph" and "Earthquakes." Dr. Klotz has intimated to me, that he will not require the whole afternoon for his lecture, and the Executive decided to have Mr. Herriott's paper on "Transportation." This should be a most instructive and valuable paper, and I hope as many members as possible will make an effort to be present.

To-morrow morning we will have Mr. Blanchet's paper, "Transportation on Base Lines," to be followed by a paper from Mr. Wallace, of Calgary, and which is in a manner, a criticism on Mr. Blanchet's paper.

In the afternoon, instead of reading Mr. Wm. Pearce's paper on the "Survey of River Lots in Manitoba," we have decided to continue reading the other papers on Transportation, this being a vital subject with surveyors of the day.

Mr. Pearce's paper will of course be printed in the proceedings.

There being some time yet at our disposal, with the permission of the chairman, I shall now read a paper on the "Transfer of Natural Resources," by Mr. Dickson, D.L.S., of Whitehorse, Yukon.

THE CHAIRMAN: You may proceed.

SECRETARY HUBBELL: It was the intention of Mr. Dickson to deal with the transferring of Natural Resources, but I see that he has changed his subject and has submitted a paper dealing with the future of Land Surveyors, as a working body.

His paper is as follows:

WHITEHORSE,
FEB. 5TH, 1914.

E. W. HUBBELL, ESQ., D.L.S.,
Sec'y., D. L. S. Association, Ottawa.

DEAR SIR:

I have, for some time, been studying a matter, or suggestion, which I think ought to be, and which I would like very much to have discussed at the next Annual Meeting of the Association. I may say it is in regard to the future of Dominion Land Surveyors as a working body, doing business and making a living through the practice of the profession.

In the first place, I would like to draw your attention to the Provinces west of, and including Quebec, six in all, which, as we all know, each have their Provincial Associations.

In Old Ontario and Quebec the Crown Lands are owned and administered by the respective provinces, as is also the case in British Columbia, with the exception of the Railway Belt and other specified tracts, which are Dominion Lands. The three interior Provinces, however, together with the territories recently given over to the jurisdiction of Ontario and Quebec, are, as I understand it, still Dominion Lands.

Regarding the new territory recently acquired by Quebec, Ontario and Manitoba, while Dominion Land Surveyors have now the same rights there as they have always had, the surveyors of the different provinces also will have some jurisdiction, and their sphere of activity will grow as the country is opened up and developed. As a matter of fact their field is being enlarged, and ours is being slowly, but nevertheless surely, curtailed. The point which will most affect us, is the fact that each province is agitating for control of its Crown Lands and natural resources, and I have no doubt that in the exigencies of politics, such control will, sooner or later, be handed over to them. British Columbia, according to press reports, is looking for territory to the north, and if such be granted, there is no doubt but that the other provinces will follow suit, and there we are.

Regarding the qualifications of admittance to the different Provincial Associations, I am not clear as to all of them. I know that in 1905, British Columbia had their Act amended so as to require a full examination.

Owing to the resolution adopted in 1892 by the Board of D. L. S. Examiners (a fact of which I was unaware until I saw it in the Annual Report of the Association. 1913), I have no doubt that Quebec, Ontario and Manitoba duly retaliated, and now require a full examination also. I am in the dark regarding the laws of Alberta and Saskatchewan, but I expect they have gone as far as the Legislature would allow them.

I am not speaking from any personal experience, but from common report when I make the statement that when a candidate (a surveyor) presents himself, while in some cases the event is considered as a matter of routine, the main object being to separate from him the necessary fee, in some Provinces the Provincial Board of Examiners (and they must be provincial in every sense in which that word may be used) seem to consider the man as a highway robber, looking for some favor he is not entitled to, and submit catch questions and otherwise subject him to such petty indignities as their ingenuity might suggest. In this connection I might say that by the same common report, Dominion Land

Surveyors seem to be the object of their especial antipathy. Under the circumstances, and in view of the fact that overtures, or at least efforts have unsuccessfully been made (I understand) looking to the standardization of qualifications which would allow the Board of D. L. S. Examiners to extend reciprocal relations to them. I am of the opinion that we, as an organization, should take steps to endeavour to prevent our being legislated out of existence.

My suggestion for discussion is that steps be taken in the proper quarters to the end that, in the event of any Dominion Lands being handed over to the control of any Province, the condition be attached that the law relating to surveys of that Province be so amended as to entitle Dominion Land Surveyors to practice upon examination on the local system or systems of surveys, and upon payment of the regular fees. As far as the Dominion authorities are concerned, I do not anticipate any difficulty, in fact I do not see upon what grounds there could be any.

When the Doninion Lands Act was passed in 1872, all surveyors in Canada, in practice at that time, I understand, automatically became Dominion Land Surveyors, and they have since become a very efficient body, their duties ranging from one side of the continent to the other. It is not conceivable that the Government, should the matter he placed before it, would now take any steps that would wipe that organization out of existence. The Board of Examiners at Ottawa have facilities to aid them in adopting a standard of qualification which are not at the command of any other Association in Canada, and that fact shows on the face of it, that those Associations requiring a full examination, have not the standard of the profession in view, but simply that they shall have a close corporation.

There are a large number of Dominion Land Surveyors who are entitled to practice in one or more provinces, and there are many who have not that advantage. On the other hand there are a large number of Provincial Surveyors entitled to practice on Dominion Lands, and likewise some who are not so fortunate. Personally, I would like to see a broader and more generous, and less of that sectional feeling among the different Associations. Always maintaining that this organization is the parent one, and that the Board of D. L. S. Examiners is better qualified to fix a standard than any of the Provincial Boards, I would be quite in favor of extending reciprocal rights to Provincial Surveyors when they bring their standard up to the approval of our Board.

Yours respectfully,

H. G. Dickson.

Mr. Aylesworth: I might say a few words on this subject, and before beginning I wish to compliment you, Mr. Chairman, on the honourable position you occupy—there is no one in the profession who has fought out the battle of the members in a better way than you have, and you are certainly deserving of all the honours going.

In regard to this paper; this is a paper which touches a very vital point in regard to Dominion Land Surveyors. We have been graded out of Alberta, Manitoba and Saskatchewan practically, and it is going to be hard on all those who have not become connected with the Provincial Association—this paper is very opportune—I do not know how there is going to be brought about the reciprocity that Mr. Dickson speaks of, but the medical profession have been aiming at that, that is, to have the different members of one Province able to practice in other provinces; and the lawyers are aiming at the same thing, and I do not think that surveyors should be behind in the ranks in this respect. Of course, what is mentioned in this paper is something that will take place in the future by an adjustment of the examinations. If proceeded with on the lines Mr. Dickson suggests, it would come about after we old men have gone to our last reward. I would like to see something brought about now, before the natural resources of these Provinces are handed over to the different Provinces. I always thought the best thing we could do would be to appoint a lawyer. When the Provinces would be granted autonomy of those natural resources, we will perhaps be away in the tall timbers, and I think it would be a good idea to have our case taken up by a good constitutional lawyer, who will defend us in this regard. In the meantime, I will move that the paper be adopted and printed in the proceedings.

It was moved and seconded and duly carried, that the paper be published in the proceedings.

Mr. Dennis: If I heard correctly, Mr. Dickson thought that in the new parts added to Ontario and Quebec, Dominion Land Surveyors have the same rights now as always. Is that correct?

Mr. Herriot: I do not think a Dominion Land Surveyor has any rights there now, for as soon as it is handed over to the Provinces any rights they had are extinguished.

Secretary Hubbell: While the Dominion Land Surveyors there, have the same rights now as always, the surveyors of the Provinces will also have some jurisdiction and their sphere of activity will grow as the country opens up.

Mr. Dennis: I do not think they have the same rights.

The Chairman: I doubt it very much.

A Member: Manitoba is different from Ontario, but all North of Manitoba is under the jurisdiction of the Dominion, and until handed over to Manitoba the Dominion has jurisdiction—who has jurisdiction of all that portion of Ontario and Quebec spoken of—I do not think the Dominion has?

The Chairman: It formed part of Keewatin—then, it is under the jurisdiction of the Dominion Government.

Secretary Hubbell: In Winnipeg last fall, I met Mr. Turnbull, D.L.S., and we discussed this question about the boundaries of Manitoba. He was not sure whether the Dominion Land Surveyors could practice in the new addition of Manitoba as heretofore, and I was not in a position to advise him one way or the other: I am in the dark whether Dominion Land Surveyors can practice there as before.

The Chairman: Perhaps Mr. Herriot might say something about the conditions there.

Mr. Herriot: In Manitoba the Provincial Land Association have exercised no right at all over the new land except as far as the ————————. I think they exercised that right, but as far as surveying the re-organized territory they have no authority whatever, and until that land is bounded they have no authority in the new part of Manitoba.

Mr. Aylsworth: It is my impression, also, that as soon as this land is handed over to Manitoba it comes under the jurisdiction of their land laws, and they cannot touch it until surveyed, and it seems to me the Manitoba Government is the one to survey it unless there is some special arrangement with the Dominion Government to carry it out.

Mr. Dennis: Manitoba is in the same position as Alberta and Saskatchewan—where Dominion Land Surveyors may work on Dominion Lands. As soon as the land is patented, jurisdiction over it becomes vested in the Province, and as such may be surveyed only by Provincial Surveyors.

Mr. Aylsworth: That is all right, but suppose the land is handed over to these Provinces—they have the natural resources and everything, and where does the Dominion Land Surveyor come in?

Mr. Dennis: That is a different matter.

Mr. Aylsworth: That is what they are asking for, and that is what we are trying to protect ourselves against.

Secretary Hubbell: In connection with the transfer of lands and suryevors' rights, it affects the Dominion Land Surveyor in many ways, and it might be advisable for the Association to take the matter up and find out from proper authorities what our rights are. A Committee might be appointed of resident surveyors in Ottawa, who have the interests of the Association at heart, to interview parties and find out our status in all the provinces, especially within the newly acquired boundaries of Manitoba.

A Member: I move that the Committee be appointed, composed of Mr. Aylsworth and Major Hubbell.

The Chairman: It cannot be determined from the Justice Department, where we stand?

Secretary Hubbell: We can perhaps find out from them who are the proper authorities to apply to.

The Chairman: Find out whether in the transfer of lands to the Province our rights would be jeopardized.

On motion duly made, seconded, and carried, Mr. Aylsworth, Mr. Dennis, and Secretary Hubbell were appointed a Committee to ascertain just what the rights of the profession will be in cases of transfers of land and resources from the Dominion to the Provinces

Mr. Akins: When may we expect a report on this?

Secretary Hubbell: This matter will require considerable consideration, and we might want to know whether it would be advisable to consult a lawyer.

The Chairman: Cannot we state a case to the Department of Justice and get a ruling?

Secretary Hubbell: I think we could do that, and in reply to Mr. Akins I may say, that this matter will be taken up, as far as I am concerned, probably this month, or as soon as possible, and I shall find a way to notify the members as to the result.

Mr. Aylsworth: It appears to me that the Department of the Interior have a solicitor, and I think it would be according to the rights of this Association to have the matter submitted to him—we are charges of the Department of the Interior, as it were, and we have a right to be protected surely as well as the Indians, we were induced to enter this profession through the Government owning these lands, to survey them, and I think we have certain rights to the soil, and if there is a solicitor in the Department, I think we are entitled to his information on this matter.

The Chairman: I think the Deputy Minister, if the case is submitted to him, would have a decision given,

Mr. Robertson: I do not think very much will be accomplished by the Department of Justice, but I think it is a matter to be brought up when the proposed transfer is to take place, and the best way is to have the matter fixed at the time. Dr. Deville is interested in the matter and he could do more in the way of protecting us than consulting any solicitor—we have no legal right, and if we have no legal right, a solicitor is no good in the matter of helping us. Dr. Deville has done a great deal for the Land Surveyors, and I think all possible would be done in consulting him.

Mr. Aylsworth: We should know exactly where we stand and be prepared when the resources are handed over, in order to defend our rights. A soldier going to war has no resources—he is at the mercy of the nation that he represents, and a surveyor ought to be in as good as position as a soldier—he is at the mercy of the public, and I think we ought to know our rights and be ready to submit them. I do not say we have legal rights—that is a drawback to us, but we want to protect whatever sentimental and professional rights we have in the matter.

Mr. Robertson: I made the remark more as a suggestion as to the more effective way of proceeding.

Mr. Dennis: We have no legal rights in Alberta and Saskatchewan, on patented lands, because we did not maintain our rights when the Acts were passed—if we could get the Acts which transferred these lands to the Provinces correctly worded, we would have rights and I presume that is what the Committee appointed should look after.

The Chairman: The first step is to find out what our rights are—if none, then we will use some lobbying to have the Land Surveyors protected.

Mr. Aylsworth: When Alberta and Saskatchewan were granted autonomy, our rights should have been placed before the proper authorities—when the natural resources were handed over, and if we organized to submit our rights at the proper time, we might get some recognition and be handed back something that we have been deprived of.

Secretary Hubbell: This is a matter I again repeat, is of vital importance to Dominion Land Surveyors—as one speaker had just stated; we have not been treated as generously as the Indians or Half-Breeds—they at least were given grants of land, but surveyors who were the real pioneers of this immense territory have had nothing given them. It appears to me that there is no valid reason why surveyors should not have a homestead or even a half-section of land. They have opened the country for other peoples' benefit and have suffered many privations and hardships, and I may say that a number of the surveyors in the Western Provinces have spoken to me on this subject, we have no time to take up homesteads as we are engaged by the Dominion Government surveying nine or ten months in the year, and have no opportunity to do homestead duties, why not, as an acknowledgment for the good and beneficial work done by surveyors in the country, cannot the surveyor receive some tangible recognition from the Dominion Government, for their meritorious work. I would like to see some action taken in this matter by our Association. Our Association is a large body, comprising 233 members, increasing in membership all the time. If members would act unanimously, we might accomplish a great deal by submitting our claims for a land grant, and submit them to the Hon. the Minister of the Interior. I am merely throwing out this suggestion in order that the question may be discussed and some light thrown upon it by the members present. If we do not talk about this among ourselves, we cannot learn the opinion of our members in the matter. Now is the time, at our Annual Meeting, to discuss matters of interest to the surveyors, and if possible try to improve and remedy grievances. In reference to the newly acquired territories to the provinces, as Mr. Aylsworth says, we were not consulted in connection with the law as to what was taken from us in Alberta, Saskatchewan or Manitoba—we should, therefore, get at this now good and hard. There may be differences of opinion, but I think, as suggested, and with all due deference to the remarks of one of the members, if we obtain a decision from the Department of Justice, it would, at least, direct us as to the right way to proceed. I think, gentlemen, we ought to consider these suggestions and receive the members' views. Now is the time to act not postpone matters of this nature.

Mr. Aylsworth: Following up the idea of our Secretary, I think that idea about surveyors being granted homesteads is one of the best yet. (Applause). You hear of soldiers going off to South Africa and of some staying at home, and whether he went or stayed at home he managed to get scrip. Surveyors are Canaians, as a general thing, and serve their country—if any professional men serve their country. When you read Mr. Pearce's paper on the early surveyors of Manitoba, many of the surveyors of the day will be greatly surprised. One of the remarks he made in that paper was that when surveyors were trusted with money to travel and to prosecute their work, never did one fail to give true and honest service, or fall by the wayside, in prosecuting their work, and in every way they were the guiding lights for the settlers—their work in those days was accurate, and they never failed in their duty, but went through all kinds of hardships, and many of them at a loss. I think, when you count up the men who were the surveyors of those early days, Mr. Harris, and Moses McFadden, I do not think they are millionaires at all, or men who accumulate much of this world's goods, in carrying on those surveys, and their services have never been recognized, and the least that could be done is to give each surveyor a homestead, and whether it would consist of a quarter or a half-section, depends upon the generosity of the powers that be, but we are entitled to something.

THE CHAIRMAN: Six feet by two.

MR. AYLSWORTH: That is all probably we will get, and will probably have to pay for that out of our savings. We are away in the field—and we are prescribed by the duties of our profession from complying with the homestead laws—we cannot get a homestead, and I do not think there is any profession but what can comply with the homestead laws, but the surveyors, and they are the very ones that should be permitted to comply with them—it would be a small recognition anyway of our services.

SECRETARY HUBBELL: I think members of Parliament should be approached in this matter. The members, when previously approached have helped the Association as a whole, when any matter was placed properly before them, and I think this is a matter, especially amongst us older surveyors, who have spent our lives in the field, that we are entitled to some privileges as to Government grants; as Mr. Aylsworth says, men who went to South Africa..................

A VOICE: And Fenian Raiders.

SECRETARY HUBBELL: Yes, and some that were not Fenian Raiders.—I think we should have the matter brought up if necessary, in the House of Commons—we could do so without injuring ourselves or doing anything adverse to the rules of the Department. If some members of the Association have friends among the Members of Parliament, now is our time to take the matter up. Many surveyors think we are entitled to a half section of land, not only a quarter section.

Mr. Aylsworth: The last time I was in Ottawa there were a few old surveyors who tried to get a homestead—they went to the homestead commission here and stated their case in a very dramatic way, and appealed to the Homestead Commissioner, and he said their arguments were sound—it might be only a matter of modesty on our part in not making the request before, and if our case is put before the proper authority we will get recognition. When these two surveyors had stated their case, the Commissioner said their arguments were perfectly sound.

Mr. Herriot: Speaking personally, that handicapped me considerably. Four years ago I wanted to take up a homestead, but owing to my arduous duties I could not—it gave me no opportunity of putting in actual service on the land.

Secretary Hubbell: What is the best way of remedying this?

The Chairman: First of all, I think the law is against us—the Dominion Lands Act is against us and it will have to be amended. I think myself the Dominion Lands Act stands in the way of a surveyor taking a homestaed, and I think the first step would be to have the law amended so that the surveyor might take up a homestead. As it is now, I do not think the Act will permit of it.

Mr. Aylsworth: I think the law should be amended so as to allow them to take the land without complying with the homestead laws.

The Chairman: There might be objections to that because they would say the surveyor had peculiar advantages in laying out a country.

Mr. Aylsworth: They deserve to have them.

The Chairman: But they would not take that view of it.

A Member: Could it not be made in the way of a superannuation?

Secretary Hubbell: Mr. Chairman, as we have finished the programme called for this morning, and a little more, I do not think there is anything more to be done this morning, and this afternoon's lecture by Dr. Klotz, together with other business, will take up the whole of the afternoon. There is a paper to be read by Mr. Herriot, on "Transportation on Base Lines." It will be very interesting, and it is to be hoped every member possible will follow it up. This evening there will be the banquet at the Chateau Laurier.

THE CHAIRMAN: This lecture of Dr. Klotz will be very interesting. Seismography is a new science, and surveyors will find it both instructive and entertaining. I deeply feel the honour you conferred on me in asking me to preside at this meeting, but I am sorry to say that I must break off now. I thought I had strength enough to go through with the session, but I find that I have not the strength, and you will have to get some other gentleman to replace me. If you select Mr. Aylsworth, our Vice-President,I think it will be met with approval. I regret very much at having to retire.

SECRETARY HUBBELL: Does that mean you will not be able to preside during the session?

THE CHAIRMAN: I will not be able to take the chair after this—I am very sorry, but that is the case.

SECRETARY HUBBELL: You have heard the Chairman's remarks that he is physically unable to carry on the duties of Chairman, I regret it very much indeed. He is one of our ablest members, and one of our oldest surveyors, whom we all think a great deal of, and will continue to do so; but in view of what he says, I think it is quite right that our Vice-President, Mr. Aylsworth, should occupy the chair if he is good enough to do so and it will be appreciated. I therefore move that Mr. Aylsworth occupy the chair for the remainder of the session.

Motion seconded and carried.

MR. AYLSWORTH: Well, Mr. Chairman, I regret very much the circumstances. If it has fallen to my duty to occupy the chair, I consider it to be an honour, of course, but still this is one of the cases where we are members of a profession, and honours of this kind should be passed around, for I consider it the greatest honour of my life. I have occupied it for municipal honours, but this is the greatest of all. (Applause). I regret the circumstances last year and this year also, but still if this is the only way out for me to monopolize the position, I am not going to see the Association fall by the wayside on that account, and will do my duty—still I regret all these circumstances, and perhaps some arrangement may be made by which I may be relieved of some of the responsibilities—to-night, perhaps a toast-master might be appointed at the dinner. In the meantime we will have some valuable papers this afternoon, and I will ask you all to come around and have a rousing discussion—they are of vital importance to the profession.

The session thereupon adjourned until three o'clock in the afternoon.

DOMINION LAND SURVEYORS' ASSOCIATION.

Carnegie Library,
Afternoon of March 3rd, 1914.

Mr. C. F. Aylsworth (in the chair): Gentlemen, the time has arrived to begin the proceedings this afternoon, and unfortunately I am called upon to act as your chairman. A year ago upon the resignation of Mr. Belanger, it fell upon me, your humble servant, to act as your chairman. This year I thought that a change should be made and Mr. McArthur was honored this morning, but he fell by the wayside. He became sick and is unable to proceed further with this meeting. It will therefore fall upon me to fill his place as chairman of your Association, and I feel highly honored. The lecture we are to have this afternoon is by Dr. Klotz, upon "The Seismograph and Earthquakes." I will introduce Dr. Klotz. (Applause).

(The following delivered *ex tempore*):—

Dr. Klotz: Mr. Chairman and confreres.—If you will permit me, I will be a little reminiscent. It was on the 24th of April, 1882, that the land surveyors who were in the Government service gathered at Winnipeg, and had a meeting. Amongst other things the suggestion was made that an association should be formed. In the following year, 1883, many of the surveyors met here in Ottawa, and at this meeting it was resloved to form a Dominion Land Surveyors' Association, which met for the first time the following year, 1884, just thirty years ago. If it will not weary you, I will read to you the names of those who were present at that meeting:—

President: Otto J. Klotz.

Vice-President: A. C. Talbot.

Secretary-Treasurer: A. F. Cotton.

Executive Committee: Wm. Pearce, G. C. Rainboth, J. P. B. Casgrain.

Auditors: C. F. Miles and E. Bray.

Messrs. W. A. Ashe, F. W. Armstrong, C. B. Abrey, Edgar Bray, S. Bray, C. A. Bigger, Jas. Burke, Thos. Breene, W. Beatty, A. F. Cotton, W. Chipman, Wm. Crawford, J. P. B. Casgrain, J. J. Dufresne, J. W. D'Amours, P. T. C. Dumais, Thos. Drummond, C. Desjardins, J. Doupe, L. M. Duchesne, Z. C. Dupuis, J. Dudderidge, Jno. Francis, Thos. Fawcett, C. E. Fitton, J. F. Garden, T. S. Gore, R. W. Hermon, O. J. Klotz, J. A. Kirk, T. Kains, J. B. Lewis, C. F. Miles, G. E. McMartin, L. J. Michaud, J. J. MacArthur, A. W. McVittie, C. A. Magrath J. Maddock, G. A. Mountain, J. S. O'Dwyer, Wm. Ogilvie, L. R. Orde, Wm. Pearce, A. P. Patrick, H. B. Proudfoot, F. Purvis, T. J. Patton, H. H. Robertson, G. C. Rainboth, R. Rauscher, J. G. Sing, J. A. Snow, G. A. Simpson, I. Traynor, A. C. Talbot, C. E. Wolff, Wm. Wagner.

Honorary Members: The Surveyor General, Capt. E. Deville, W. F. King, Prof. Selwyn, Prof. Macoun, Dr. Bell, Prof. G. M. Dawson, Prof. Harrington, Andrew Russell, E. E. Taché, and Bolton Magrath.

Having read those names I am reminded of Maeterlick's Blue Bird, one of the prettiest stories in the English language. I recall that Tyltyl and his sister visit the kingdom of Memories. He meets there his grandfather and his grandmother, seated together. Tyltyl says: "I thought you were dead." "No," said his grandfather. "We are not dead when you think of us, when you speak of us, when there are kind thoughts of us, we are not dead." A good many of those surveyors have crossed the border line. Let us say, that we think of them, that there are kind thoughts of them, and therefore they are not dead, to us.

My address is given on the programme as on the seismograph and earthquakes. Now, we as seismologists, are concerned more with the effect of earthquakes than with their cause. The cause of earthquakes is not my province and I do not intend to enter into any explanation of their cause. I might refer casually, however, to one or two things. Generally the earth is considered a cooling mass. That is something we have no direct proof of, and consequently do not know the amount of heat given out by the earth and the consequent shrinkage that might be attributable thereto. It is simply a plausible explanation that has lost some of its force since the discovery of radium which gives out heat continuously. Something of which we have more definite knowledge is the stress on a body, which changes the shape or size or volume of a body, and the effects or strains produced by these stresses. We know that the meteorological conditions, by that I mean those due to rain, snow, sunshine, &c., have an effect in changing the stresses upon the earth.

Daily, these meteorological conditions alter and influence and play a great part in changing the stresses upon the earth. There are other meteorological influences that are contributory to setting off an earthquake, when the strain reaches the limit in the crust and interior of the earth, and that is, for instance, a very rapid change in the barometric pressure, which is ordinarily supposed to be nothing. However, we may have a rapid change of two inches in the barometer. It means that you get an increased pressure at the sea level of about 144 pounds to the square foot. Put that additional strain on the earth's surface and it may be just sufficient to fire—to set off—our earthquake. Not that it will directly cause the earthquake, but it may be the one cause that fires the earthquake when it is nearly "ripe." Another cause is that of the physical tides of the earth We all know of the tides of the oceans of the earth, but we have also physical tides of the earth itself. The moon produces stresses upon the earth, and that, under certain circumstances, may fire our earthquake. Now to get down to my subject. I have made a few notes to prevent me talking too long, and I want to show you a number of records of earthquakes. I will just say in passing, a word about volcanoes. It is the general belief that volcanoes and earthquakes are associated. They are quite distinct phenomena. Volcanoes are confined to the skin of the earth, while earthquakes are generally much deeper. But there are effects that follow both volcanic activity and earthquakes that we are concerned with. Earthquakes, of course, affect the very life of our earth. These great volcanic eruptions, the greatest in historic times being that of Krakatoa, in Sumatra, in 1883, poured immense quantities of fine dust into the upper regions of the atmosphere. In the case of Krakatoa, this dust remained there for several years and was noticeable by the many beautiful sunsets which were prevalent soon after that eruption. These particles in the high regions, however, interfere with the radiation from the sun and prevent us from getting all the heat and solar energy we should receive. Another recent eruption was the one at Katmai, in Alaska, only two years ago. Here again, immense quantities of dust were thrown into the atmosphere and interfered with the radiation to a very great extent. One of the constants which scientists have been trying to determine is called the solar constant, that is the amount of heat that is poured out by the sun falling vertically upon a square centimetre of the earth's surface during one minute. In this last volcanic eruption at Katmai, observations were going on for the determination of this solar constant at Mount Wilson in California, and on the northwest coast of Africa, in order to see whether the constant was the same in the Mediterranean as at Mount Wilson, where the altitude was far greater. Professor Abbot, who was observing in Africa, noticed on a certain day in the latter part of June, 1912, that there was a very material reduction in the constant, and he could not explain the reason. This was on the northwest coast of Africa, where the weather is habitually fine and the sky cloudless. However, directly he learned of this eruption in Alaska, he concluded it was undoubtedly attributable to it, because the similar phenomenon was observed at Mount Wilson, and I may add, also at our observatory here, where, although we were not making observations of the solar constant, we noticed a diminution of the light and of the transparency of the air. An interesting fact in connection with this eruption is that, although California is much nearer to Katmai than is Africa, yet Professor Abbot observed this reduction of temperature sooner than it was observed in California; showing that the particles in the upper atmosphere were carried to Africa before they reached California. With these preliminary remarks about the earthquake causes, let me just refer to another matter before I go to the instruments, and that is, as to whether we will ever be able to make any forcast of earthquakes. That is a very difficult matter, but Professor Kövesligethy has made an effort, based on physical, scientific and mathematical reasoning. I will simply indicate the idea which underlies his forecasting, which is only applicable in a seismic region, which we are not here, but in Japan and Italy it should receive consideration. The idea is this, that every time there is an earthquake, there are strains produced in the material by the disturbance which affect its conductivity as far as its velocity is concerned. So that if you get a series of records of earthquakes, you will find a definite velocity in the seismic wave for each, and will then be able to predict when a cataclysm must come, when the material is approaching a strain which it will not be able to stand any longer. This theory is not to be put in a class with that of the proximity of the moon, conjunctions of planets, or some other untenable theory. It is based on a theory of mathematics.

Now as to instruments. It is only within comparatively recent years that we have records of earthquakes. The earthquake country, per se is Japan, and there was begun the earliest attempts to register earthquakes. Japan invited scientists from various countries to come and teach them at the universities. They had professors from England, Germany and France, and among others who came were Professors Milne and Ewing. Professor Milne, the father of modern seismology, took a great interest in earthquakes and devised an instrument for recording them. Ewing had one also, so we got several different records of earthquakes. These instruments, however, in addition to recording the earthquakes, registered themselves, which was a very disturbing feature, and it was only in the beginning of the present century that German scientists took hold of seismology in order to deal first with the instruments themselves, and not with earthquakes; and let me tell you right here that the mathematics of these instruments is far more difficult than the study of telescopes. There is much more in the theory of the seismograph than in the theory of the telescope. They made a scientific investigation of the instruments and invented seismographs, and these are the instruments used at the present time, giving the most reliable data. The principal thing is to record what the earth is doing and not what the instrument is doing, so that it is necessary to have a steady mass, a mass that remains quiescent, or as nearly so as possible: and let the earth do the shaking and recording. It should be, as if there were an invisible hand which is not of the earth or on the earth, holding the instrument at one end, and when the earthquake comes along it is only the other end attached to the earth that records on the sheet; so it is essential, as I said, to have a steady mass. I have a number of well known earthquake records here, including the San Francisco one, and you have in your hands the record of the recent one in Ottawa. Now our instrument (one for the N-S component, and one for the E-W.), is comparatively simple. We have a mass of two hundred grammes suspended by fine wires from an almost vertical rod and it swings horizontally. Let me illustrate it by means of a door. If the hinges of a door are not vertical there is a certain position where the door will remain at rest. So it is with the horizontal seismograph. We tilt its support just a little and we get thereby a long period of oscillation, and a definite position of rest. This instrument records photographically. It is at the present moment, I think, the only highly sensitive instrument recording photographically on this continent. The Toronto instrument was a very good one in its day, but it is now out of date. Many of the modern instruments have mechanical registration. The reason why more have not photographic registration is that they have no photographic equipment for developing their records daily, and it is more expensive. I have now told of the steady mass of our seismograph and of the pendulum. Now the earthquake with its sudden sharp shock comes along. Of course it shakes the pendulum and the pendulum is apt to start to oscillate. What we want recorded is the movement of the earth and not the movement of the bob. We have therefore to damp down this movement of the pendulum. There are two methods of damping it. We could damp it in an air chamber, or we can damp it magnetically. Ordinarily where they have a very heavy seismograph, as in the German institutions where the mass is perhaps a thousand kilograms, that is about a ton, they use air-damping, whereas we have only a little bit of a thing weighing 200 grammes. They have also mechanical registration and hence there is a certain amount of force required to overcome the friction and write on the smoked paper. This may mean the loss of a weak shock on the record. Now, I was telling about damping. At the observatory we have a big horse shoe magnet of wolfram steel, and to the steady mass there is attached an alluminum vane which moves in the jaws of the permanent magnet. The effect of the magnet is to stop the steady mass when set in motion, and allow the earthquake alone to register by the other end. Thus the registration is of the earthquake and not of the instrument. In the ordinary clock pendulum we have the bob swinging from side to side, but in our case we have the pendulum quiescent and the earth does the swinging or oscillating. We have now the pendulum damped down. The next thing we want to do is to magnify the motion of the earth itself, which is very small, that is the earthquake. In this last earthquake here the movement of the earth was only five hundreth of an inch. So you see that we could not measure with our instrument unless we devise some means to magnify that motion. We do that very simply by having a small silver mirror over the point of rotation of the horizontal pendulum. As the earth moves and the steady mass remains quiescent, this mirror changes its position and a beam of light is reflected from it into the recording drum some 14 feet away. Our mean time clock cuts off the light for one second, every nimute, and that enables one to read the seismograph in terms of time. By means of the beam of light then we obtain the magnification. The farther away the recording apparatus is from the mirror, the greater is the magnification. Ours magnifies 120 times. This magnification, however, is theoretical, for everything the seismograph does is not magnified one hundred and twenty times. The magnification depends not only on the theoretic magnification, but it also depends upon the period of the pendulum and the amount of damping. The damping down of our pendulum is about one to five, that is, if you let the pendulum swing freely, put on your damping and the oscillation that it makes then is one fifth of the immediately preceding one. That is most suitable for reading our seismograph. You can very well understand that friction comes into play in mechanical registration. With the beginning of an earthquake having very rapid oscillations, and then only, do we obtain the theoretical magnification of 120. It may run down to thirty or less, depending on the period of your earth particle. So in reading the seismogram we have to use different magnifications. I mentioned we have our seismograph connected with our mean time clock, so that fortunately with our seismograms there is absolutely no time correction. It would only be a very small fraction of a second in any case. As far as I know, and I have visited very many stations, it is the only seismograph directly connected with an observatory mean time clock. The others have all separate clocks connected with their seismographs, necessitating a daily comparison between the seismograph clock and a standard clock, which is certainly an inconvenience. This question of time is one which affects the seismograms and is most unsatisfactory in the records from some stations. Some of the records of the earthquake on the tenth of February last, were accompanied by a note saying that they did not know whether their time was correct or not. I have one record where the time is recorded before the earthquake took place. (Laughter). That shows that the time is not very satisfactory. We are getting over this difficulty of time, however, by the wireless time signals from the Eiffel Tower, Norddeich and Arlington. These time signals are sent out daily and at present it is very easy and cheap to get a receiving apparatus, and by that means one is able to get time readily within a second.

When we have our seismogram, the question is to read it. We have first to find what the instrument was doing. If we had a perfect one we would only read what the earth was doing. But we cannot have the seismograph held by an invisible hand out in space. You will see that if all is well and no quake, the record continues in a straight line. When the earthquake comes we have an offset. When we examine that we try to see from where the earthquake comes. Now we have learned to recognize that there are three distinct kinds of waves. There are the longitudinal waves, there are the transverse waves, and the undulatory or those on the surface of the earth. The first or longitudinal waves travel the fastest, the next with less velocity and the last with still less. With regard to velocity we know it bears a relation to the substance and its density and elasticity. We have found, as I said, the different velocities, and we know that the surface waves which are the last, are confined to the surface of the earth, and travel with a constant velocity of about 200 km. a minute, whereas the others travel through the earth and with differing velocities dependent upon the depth. The San Francisco earthquake was distant about three thousand eight hundred kilometers, and the propagating ray dipped about 300 kilometers down into the earth. The place in the earth where the earthquake occurs we call the hypocentre. We know that the earthquake does not take place at a point but rather in a plane. However, in treating it mathematically, we treat it in the first instance as emanating from a point, and you will very well understand then that waves which are propagated will be spherical waves. As we have now our hypocentre, the point directly above it on the surface of the earth, is called the epicentre. It is a term to which we refer very frequently. The velocity of the seismic wave depends on the nature of the mass through which the wave passes, that is, if we knew the moduli of elasticity and the density of the material, we can compute what the velocity through it must be; and inversely, when we know the velocity we know then the ratio of these moduli to density, thereby giving us definite information of the interior of the earth. That is something which, before modern seismology was born, was comparatively in the dark. We had always to rely for our information as to the interior of the earth upon what the geologists told us. Their inferences were naturally based on temperature readings in borings and mines to a depth of about a mile, noting that the temperature changed so many degrees in so many feet of depth, and then concluded from the conditions in this thin skin, a thickness of only $\frac{1}{4000}$ of the radius of the earth, what the conditions must be in the interior, giving us generally a molten interior. That is wholly untenable now;—the theory of a molten mass in the interior of the earth,—for, transverse waves cannot be propagated in such material. We know that these waves are propagated, and for that reason we have now a different proof of the constitution of the interior of the earth. A messenger has come to us and told us in writing the story of his path through the earth. It remains for us to interpret what he has written. We must decipher the Rosetta stone. But we must interpret it properly.

Of course it takes some experience to understand and read what the different waves are. I come along here (pointing to a seismogram), and I find the longitudinal and transverse waves fairly well defined. I get then the distance in time between the arrival of the longitudinal and the transverse waves, and by this means we are able to discover whereabout, the earthquake took place, or rather, the distance to the epicentre. Let me illustrate it by an analogy. Supposing two trains leave a certain point at the same time. One is an express train and the other a freight. You know the freight is travelling at twenty miles an hour and the express at thirty miles an hour. Now you are in some far-away place, and note the times of arrival of the two trains. Let us suppose that the freight train arrives 6 hours after the express train. From this we know that they must have travelled 360 miles in order to get 6 hours apart. That is how we get at the distance of an earthquake. We measure the distance in time between the arrival of the longitudinal and the transverse waves and from that we know the distance. Although we now know the distance to the earthquake, we do not know where it was. We now look at the first offset in the seismogram for the two components I told you about, because from this we are able to calculate the direction. There is the north and south component and the east and west one. It is not so simple as I am telling you. From the two rectangular components, expressed in microns, we obtain the diagonal of the parallelogram of forces, *i.e.*, the line or vertical plane of the propagating ray, but involving ambiguity of direction; for example, whether it is N.E. or S.W., N. W. or S.E., and so on. Our vertical seismograph, however, which I may mention has mechanical registration and necessarily a very much heavier steady mass than the horizontal seismograph, decides the ambiguity. We are dealing with the first impulse, the longitudinal wave, a wave of compression and dilatation, where the earth particle moves to and fro. In its excursions, the steady mass of the vertical pendulum will move relative to the earth up and down, and this shows itself on the seismogram; that is, on the seismogram we can tell whether the motion at the moment was one of compression or dilatation, and this will determine the ambignity, and give us the definite and unmistakable direction. I may say that in the recent earthquake here, the direction was north-east. It is frequently difficult to measure the horizontal amplitudes satisfactorily.

For finding the geographical position of an earthquake, recorded at two or more stations, I have computed tables for the principal earthquake stations of the world, by means of which the position of the epicentre can be readily found by a simple graphical construction. These tables have been published and are available. By means of these tables one can usually tèll in about fifteen minutes whereabouts the earthquake was, of which there are several satisfactory records.

The degree of rigidity of the earth is made known to us through calculations which we can make based on data of earthquakes. In the old days of course the earth was looked upon as solid and unyielding. It was Kelvin that first began to question the rigidity of the earth, and that was in connection with the tides of the ocean. He began to reason that these tides on the ocean were probably not as large as they would be if the earth were absolutely rigid, and he made an investigation, and found that the earth was not absolutely rigid, and that the tides of the ocean were not as large as they should be if the earth were rigid. If the earth were perfectly elastic it would yield to the attraction of the moon equally with the ocean and there would be no tides; so that the tides we measure at the present time are simply differential tides; differential tides of the water and of the earth. I may tell you that at the present moment we are having dug two vaults at the observatory for the installation of two new seismographs and instruments to aid in measuring the "give" of the earth by the attraction of the moon.

It remained for Professor Hecker, who has been engaged in measuring these tides of the earth, to discover a remarkable anomaly. The question arises, whether the earth is as squeezable, if I may so term it, in one direction as another. Hecker found that the earth was evidently more elastic, more squeezeable, in the north and south direction than in the east and west direction. He submitted his theories and discoveries a few years ago to Professor Love, who threw out the suggestion that the apparent anomaly may be due to the effect of the oceanic tides. At the last meeting of the International Seismological Association, at Manchester, in 1911, this matter was brought up and it was then decided to make observations in several parts of the world with regard to these physical tides of the earth and the anomaly involved. The places selected are, one in the centre of South Africa, one in Siberia, one at Paris, and one in North America. For the last the above vaults are being built, and the Dominion Observatory will participate in this international investigation.

The effect of earthquakes is obvious to you all. If any of you made any enquiries regarding the recent earthquake here, you will find that the effects were different in different parts of the city. It all depends upon what the nature of the ground is, on which the houses stand. The disturbances of an earthquake depend primarily upon the acceleration or change of velocity. You can move an object a long way, even move a house without doing much damage, but when there is a rapid change of velocity, dire results may follow, although the actual motion itself is small. I recall one report of the recent earthquake given by a man, who said that it shook up his hens so much that they all immediately laid eggs and he had never had so many eggs on hand before. This was acceleration.

We had a disturbance in Canada some years ago, though the most famous one that we ever had was on Shrove Tuesday in 1663. Earthquakes in Eastern Canada are apt to take place along the St. Lawrence River, where our great geological fault in Canada is. Although we are not in a seismic region, yet should a severe earthquake take place, it will occur along the St. Lawrence and

Lake Champlain fault line, extending to Anticosti, and into the Gulf. One of the reasons for the prevalence of earthquakes in Japan is that that island is on the edge of a great trough in the Pacific, and an earthquake always seeks the weak spots. In the earthquake here in 1663, was born yellow journalism. One account says, "they saw very lofty hills striking together with brows opposed like headstrong rams, then suddenly and instantaneously swallowed up in the yawning earth. Father Charles Simon relates that a man so shuddered at the sudden earthquake, that although at other times he was brave, his hair was bristling up with horror and standing up straight shook off his fur cap."

In 1746 there was an earthquake in Peru, and an account of it says, "It is most certain that the two named causes of these calamities are heat and moisture, However, supposing such to be the case, it does not at all hinder but that the Almighty power may employ these natural occurrences as the instrument of punishment to a wicked people. There was not before the late calamity a more licentious spot upon the earth. The charm of the climate of this country, and the tranquility of life which the inhabitants enjoy, together with the extreme beauty of the women, did not a little contribute to an amorous disposition which was the prevailing passion of the inhabitants."

Now, Mr. Chairman, I am sure I have talked long enough about earthquakes, and I fear some of you would be glad if an earthquake were to stop me.

However, I can assure you that nothing would please me more than a good earthquake—of course, not here—one decent earthquake a week,—I hasten to add, in uninhabited regions.—is what we require to solve the riddle, not of the universe, but of the interior of the earth. Our earth is, after all, the most important body in the universe, and we want to study it, and the unravelling of its mysteries is one of the highest ambitions to which man can apply his energies and intellect.

Mr. Aylsworth: We have had a most interesting and scientific lecture on earthquakes, and it has been delivered to us in a most admirable way. If there are any members present who would like to ask any questions, I have no doubt Dr. Klotz would be only too pleased to answer them.

Dr. King: The point you all must have noticed in the lecture this afternoon, is the extreme care that must be taken in all measurements. That is characteristic of modern science. It is the results of measuring from which the deductions are made. Scientific men of an earlier day were content with a general observation of phenomena and did not trouble about accuracy in their measuring and weighing. But that has been altogether altered, as you must have observed from the lecture. I have listened with very great interest to the lecture and I beg to move a vote of thanks to Dr. Klotz.

Dr. Deville: There is one thing about the lecture, and that is, that although it was in scientific terms everyone could understand it, and I am sure we know more about seismograms and earthquakes than we ever did. There is one thing I would like to ask, and that is in this record I hold in my hand, I notice a certain level on the left hand and a different level on the right hand. Does that represent a permanent change?

Dr. Klotz: Yes, that represents a permanent change in the zero of the seismograph.

Mr. Aylwsorth: Before I put this motion, I would like to call upon Mr. Mountain for a few words.

Mr. Mountain: Anything Dr. Klotz has to say I am always pleased to hear, and when I noticed his name on the programme, I made sure of coming, because, as with you all, we are glad to hear anything Dr. Klotz has for us. I am sure it was a very interesting lecture.

The vote of thanks was cordially agreed to.

Mr. Aylsworth: We are now to have a paper on Northern Transportation, by Mr. G. H. Herriot. I will call upon Mr. Herriot.

TRANSPORTATION PROBLEMS IN THE COUNTRY NORTH OF LAKE WINNIPEG.

G. H. Herriot, D.L.S.

Transportation on base line surveys in the country lying north of Lake Winnipeg, resolves itself into a very serious problem, and one very different from those to be met with farther west. It has been truly said that a surveyor's work consists in surmounting his difficulties as he meets them; but in no country is this saying more completely applicable than in this northern area where the transport depends so much on physical labor, whether it be at the paddle or under the torturing influences of the pack sack or tump line. In districts where such means of transportation are the only available ones, a knowledge of the topography of the country is of the greatest possible service; and unfortunately, here the maps available are inaccurate and very incomplete, with the result that the Surveyor is more severely handicapped than he would be if other means of transport were possible.

Transportation in this lake country known as Northern Manitoba, may be considered under the following headings:—

(1) The transportation facilities that may be employed for taking in supplies.

(2) The location of caches.

(3) The transport during the actual survey.

Eash of these must be considered under the two sub-heads of summer and winter surveys.

SUMMER TRANSPORTATION.

Under this heading only the most feasible routes will be described fully, although mention will be made of the less feasible ones as well.

In summer it is still the wisest plan to enter this country by way of Lake Winnipeg, although with each mile added to the length of steel on the Hudson's Bay Railway, this advantage is rapidly diminishing; but that route will be dealt with later on. The Lake Winnipeg route may be considered as consisting of several stages.

Freight is handled over the first of these stages, which covers the distance from West Selkirk to Warren's Landing—a distance of nearly 270 miles—by the Northern Fish Co., the Northern Navigation Co., and the Lake Winnipeg Shipping Co. The Northern Fish Co. handle the bulk of the freight and give a good efficient service. From Warren's Landing two routes are open: one across Great Playgreen Lake and down the East River to Norway House, the other across the same lake, but down the West branch to Whiskey Jack portage. The carrying over this section may be done by the Hudson's Bay Company's boat, or by the private individuals owning gasoline and steam launches and towing as they do, from two to three scows and York boats. If the Hudson's Bay Company will undertake the freighting it is best to give them the work.

The supplies having now reached Norway House or Whiskey Jack portage, as the case may be, will have to be considered separately in their passage over the next stage of the route. Such freight as has reached Norway House will go down the East River to Cross Lake post, either by canoes or by York boats. The York boat is preferable as about $4\frac{1}{2}$ to 5 tons of freight can be taken down river by nine Indians. In case of high water, the York boats will require to lighten their loads only once, that is at Sugar rapids; the other rapids can be run without danger or damage to the goods, but in case of low water portages, may be necessary at other rapids. With the canoes, however, the freight and canoes must be portaged over five portages varying from a few yards to about one hundred yards. The amount of portaging is hard on the supplies, and such articles as sugar, etc., are likely to be much damaged by the water from waves or paddles as well as by the portaging. The York boat is therefore the preferable means of transportation for this stage. On the other hand, there are other difficulties which make either of these methods almost impracticable and a discussion of these difficulties may be introduced here. Most of the York boats are owned by the Hudson's Bay Company; and the remainder by the free traders in the country. Now, let it be understood that the Hudson's Bay Company are in this country almost entirely for the fur trade; and if they carry any freight for private individuals it is to accommodate and not for the resultant profits. Their own transport is of paramount importance to them, and after it, comes such aid as they can give to others. The Hudson's Bay Company are obliged to rely on the Indians for the motive power in all their transportation problems; and the Indian nature is just about as reliable when work is the consideration as a weather vane is on a stormy day. The Indians are honest, and when one has them working, give good service; but the great difficulty is to get them working. Theirs is a policy of rest when they have plenty, and work when necessity drives them to it. Last season a great deal of work was open to them from various sources, the base line surveyors in the country wanted Indians as guides and canoe men. Others were needed for the same purpose by the Hudson Bay Railway Engineers, McMillan Bros. required Indians as guides across the lakes and through the unexplored country. There were also occasional travellers, like the missionaries, who needed Indians, and lastly and most important factor in the case, the Hudson's Bay Company needed the very same Indians. As a result, the Hudson's Bay Company got them, because failure on the part of the Indians meant no debt the next winter; and the surveyors, after a delay of a day or two, were compelled to find their own way down the river, trusting to a lucky chance to carry them through the bad places. Even the Hudson's Bay Company were able to get only a portion of their supplies down to the various posts at Cross Lake, Split Lake, and Nelson House.

If York boats are used, nine Indians can handle 4½ to 5 tons of freight, while with canoes it would require probably 16 men to handle the same freight. It therefore appears that the York boat is more serviceable than the canoe, but in view of the difficulty of getting the Indian labor, both are very unreliable. The York boat can be handled only by Indians, while canoes might be handled by any intelligent person after the first trip.

For the reasons already given, the Whiskey Jack portage route is therefore the most satisfactory, providing means are at hand for transportation across the portage. In 1912, the Hudson's Bay Company took practically all their freight down the river by this route. They put a team of horses and an ox team on the portage to freight the supplies across the 5½ mile portage. In 1913, McMillan Bros., the contractors on the Hudson Bay Railway, took in about 2,000 tons of freight by this route. They brought in about 24 teams of horses, employing them for the haul across the portage. From the east end of Whiskey Jack portage all supplies were, in 1912, shipped to Cross Lake post, either by York boats or by canoes. In 1913, however, on account of McWilliams' heavy tonnage, they built a large barge with a capacity of about 40 tons, on Cross Lake, and from Winnipeg brought in a gasoline launch, which they dragged across the portage and launched in Cross Lake. They loaded the freight on the barge and towed it from the eastern end of the portage across Cross Lake and down the east channel of the Nelson river to Ebb and Flow or Shoal Falls, where it was again unloaded. Shoal Falls is situated about 8 miles below the Hudson's Bay Post on Cross Lake.

Freight taken to Cross Lake Post or Shoal Falls may be carried on to Sipiwesk Lake by either of two courses. The route may be by water, using either canoes or York boats, or it may be by McMillan's tramway, overland about 13 miles to a small creek entering Sipiwesk Lake from the south. The first method by water, using canoes, means a trip down the Nelson River to Sipiwesk Lake. This section of the river can only be safely travelled with good Indian guides, and involves 5 portages from ¼ mile to ½ mile in lenght, and in addition to these a short portage is sometimes made at the Chain of Rocks Rapids. Although all these portages are in excellent shape, still the supplies suffer severely on the journey down river, both from water and from handling.

If a York boat is used, the Duck Lake route is travelled, and as only 4 portages are necessary the supplies are not so badly damaged. The water stage is here subject to the same objections as on the section between Norway House and Cross Lake; and is therefore not to be chosen when the overland passage is possible.

In the summer of 1913, McMillan Bros. opened a cutting and laid down a tram car track from Shoal Falls overland to a point about one mile from Sipiwesk Lake, on a small creek flowing northerly into the lake. Cars were built and horses brought up from Whiskey Jack portage and supplies freighted across the portage last year.

From Sipiwesk Lake, suppiies could be taken down the river in York boats or canoes as far as Split Lake, two portages being necessary. The preferable plan, however, is to have them taken down to Manitou Rapids on McMillan Bros.' Barge. The barge will make its first trip with the opening of navigation in the spring. From Manitou rapids as far down the river as Split Lake, all freight would require to be handled either by York boats or canoes.

Split Lake might be considered as a distributing centre for surveys, either to the east, west, north or south, as canoe routes branch from the lake to the west along the Burntwood River, to the southwest along the Grass River, to the southeast via the Landing and Fox Rivers, to the northeast by the Nelson River, and to the north by the Little Assean Lake and a portage into the Little Churchill River. Therefore once Split Lake has been reached the field of survey lying to the east of the Principal Meridian is open to the surveyor in almost every direction.

Other water routes may be traced out on the map for surveys in the country lying west of the Principal Meridian; but most of these are very unsatisfactory owing to the many portages and the necessary labor and difficulties involved by them. Amongst the other routes may be mentioned those covered by Mr. B. W. Waugh's report on "Transportation Facilities in the Country North of Lake Winnipeg":—(1) The route from Le Pas to Split Lake by way of Cumberland House and a series of lakes and portages until the Grass River is reached, and thence down it to Split Lake; (2) By Cormorant Lake to the Grass River and thence to Split Lake; (3) The route from Le Pas to Moose Lake and thence by portage to the Minago River, to Cross Lake and finally down the Nelson to Split Lake. Owing to the rapid extension of the railway these waterways are becoming less travelled each year. At no time have they been able to compare with the Nelson River route, and for that reason a long discussion of their relative merits seems to be of no practical value. Moreover, as no survey work is contemplated west of the Principal Meridian, in this northern district, during the season of 1914, and as by the winter of this year the end of steel should be close to Thicket portage, a distance of 185 miles from Le Pas, there is small prospect of these water routes serving any of the immediate needs of base line surveyors.

WINTER TRANSPORTATION.

The snowfall in the country averages about three feet, and seems to increase slightly the farther north one goes. The heaviest snowfall occurs after the new year. It would therefore be advisable when winter freighting is contemplated to take advantage of the early winter months for freighting, or to wait till the snow has begun to diminish in the spring. Practically no horse feed can be obtained, so that if the supplies are taken up north in the spring, they should be taken in early enough so that the horses may be brought out to where feed is obtainable before the break up. In January of this year the end of steel on the Hudson Bay Railway had reached mile 87 from Le Pas; and on this section about 60 miles had been dirt ballasted. Work trains were being run from Le Pas to the end of steel twice a week, in order to take out material, such as rails, etc., to the material yard near the end of steel; and also to carry supplies for the contractors. Team freighting was going steadily along from the end of steel to various caches along the right of way as far north as Cache 18, that is about mileage 190 from Le Pas. Another tote road from Sipiwesk Lake strikes the right of way near this cache and follows it in a northeasterly direction, probably to its crossing of the Nelson River.

About the end of January, a party of 100 men and 25 teams left Le Pas for the purpose of opening a government road from the end of McMillan's tote road, through to Port Nelson. What progress they will make is hard to say.

Any surveyor wishing to take his supplies to Northern Manitoba this winter would therefore ship to the end of steel and have them freighted from there along the right of way to the most suitable point by McMilian Bros. teams. From the right of way the supplies could be hauled to various caches on flat sleighs.

LOCATION OF CACHES.

That properly located caches are of the utmost importance, is a well known axiom to all base line surveyors. The truth of this may be made clearer to others when they realize that the average cost of a base line survey is between $150.00 and $200.00 per day; and every day lost by the party in furthering the transportation of supplies means this losss less the small extra cost of placing caches at the most suitable points. Such extra cost is figured by dividing the total cost of placing and building caches by the actual number of days spent on the line surveyed.

In the location of caches a few general rules may be laid down, but even these general rules cannot be very closely adhered to in this northern country. Their location will, however, depend on whether the cache is to be drawn from in the winter or in the summer. If summer work is anticipated, then the caches must be located either on a lake or river that is easily reached by other water routes from the immediate vicinity of the line. The caches should moreover be placed at reasonable intervals along the water route that the surveyor plans to use for his main transportation, so that, in making the round trip, the canoe men shall not require to be absent from camp long enough to interfere with the regular production of the line. No definite mileage interval can be given, because everything depends on the river and the various factors which make them suitable or unsuitable for navigation. In locating each individual cache therefore, the surveyor should make a careful study of the main transportation route and also of his subsidiary waterways. He must consider them under the heads of current, rapids, and falls, portages and lake expansions. Unless one understands these factors and can figure on them with a reasonable assurance of accuracy, some lost time is bound to occur; and such lost time in getting the supplies through when required, cannot be figured in time and wages of the canoe men alone, for it may so disorganize the entire party that the survey as a whole suffers very materially.

After the surveyor has made himself familiar with all the possible information concerning his main transportation route and its various branches, and has as accurate a map as may be compiled showing these waterways, with the various rapids and falls shown and the portages marked and his line to be surveyed laid down thereon; he is then in a position to determine the location of his caches. Here his judgment and knowledge of such transportation will be his greatest guide. He must first consider the directions and distances to various river or creek crossings (arteries of the system) on the survey line, taking into account the current of the rivers and creeks, and remembering that it is advisable to do the heaviest freighting with the current. Therefore, whenever possible his cache will be so located that in drawing from it the supplies may be taken down stream with the aid of the current. In connection with the rapids and falls, several points must be considered. One must take into account their fall, and also ascertain whether they may be run safely either with loaded canoes or with empty ones. If too dangerous for such a proceeding, it is necessary to know whether the ends of the portage are easily reached. The portage itself must be considered under the various heads, such as its length, character of its surface, whether hilly or nearly level, and whether the footing is soft or hard. Lastly, how well the portage has been cut out, is another serious factor If cases occur where the rivers widen into large lakes, the configurations of the lakes must be considered, as regards the width, length and the presence of islands to break the surface. Where no islands occur to break the sweep of the wind, and to offer lea shores to the canoes, one can depend upon it that some days will come when the canoemen are sure to be hung up waiting for calm weather. Cases have been known where lakes not more than five or six miles long have tied up travel for as long a period as three days. However, if one guages the time of arrival at some of these lakes it is altogether likely that a crossing may be made in the evening or early morning calm; even night travel across dangerous lakes is frequently advisable as the winds are usually much less persistent then than in the day time, and the danger of gusts is practically nil at night. Now, after the surveyor has weighed ali these factors, he is in a position to decide on the locations of his cache.

On the other hand, if the survey is to be conducted in the winter time, one need have no very accurate knowledge of the waterways. The caches would then be located at suitable mileage intervals, so as to fully utilize the transport outfit attached to the survey party. If such transport were to consist of horses, a probable suitable interval between caches would be sixty miles, and this distance might also hold with dog transport, using about six trains.

TRANSPORTATION DURING THE ACTUAL SURVEY—(*Summer Work*).

In Northern Manitoba, summer transport resolves itself into the use of canoes where waterways are convenient, and to the use of the pack strap where no such waterways exist.

The method followed by the writer has been to have an equipment of about five large canoes and one small one. The chief purpose of the small canoe was for exploratory work and for packing along the line in case any fair sized inland lakes are met, where walking around would mean lost time. The large canoes consisted of one 18 foot Peterboro, suitable for quick trips, which could be fairly easily portaged, yet was sufficiently large to carry about 1,000 lbs. of freight; and four 19 foot Chestnut canoes. The latter are used entirely for freighting and moving camp. They are an excellent canoe standing rough usage in rapids, rough weather on the lakes, and hard handling on the portages. The one objection to their use is the heavy weight on the portages, and the difficulty of handling them in very swift water. An 18 foot Chestnut canoe of about 40 inch beam would probably be found to meet requirements, as to load and usage, and would not be so heavy for portaging. With this number of canoes it is possible to carry the party, survey outfit, and enough supplies to last about three weeks. This is necessary when going in from Norway House to the scene of the work.

The line may be reached by canoes at intervals varying from two or three miles to as many as ten or twenty miles apart. From crossing to crossing it is frequently necessary to man pack the supplies across these stretches, as the country is either too wet for horses or horse feed cannot be obtained. A man can pack from 50 lbs. to 100 lbs. according to the nature of the country. It is not advisable to delay the production of the line by having the axemen and other linemen do any more packing than necessary; and out of a party of twenty-one men not more than five or six can be employed as packers. It needs very little consideration to see that man packing has a limit of efficiency, because with this outfit of packers, one cannot hope to keep supplies in camp and move camp too, when the pack exceeds eight or ten miles. When the overland route exceeds this distance extra men must be taken off the line to assist the packers and thus the production of the line is delayed at the time when the greatest speed is required, for the faster the line can be produced across such stretches, the less will be the amount of the supplies required.

It is most essential that the probable length of an overland pack be known some days before it is commenced, in order that the canoe men may have sufficient supplies on hand for the crossing. In this way all the packers will be available for the actual work across the portage. The surveyor will find it advisable to assist the cook in making a proper selection as to kind and quantity of supplies to be used in the survey across such portage.

In order to get the greatest benefit from the existing waterways it is advisable to have a thoroughly reliable guide who is familiar with the country and knows every possible creek and river that may be utilized for canoe transportation. For such a guide one must turn to the Indians of the country; but, as stated before, it is a difficult matter to get hold of the Indians. They have to be hired at least in pairs, as one Indian will not remain with a party all alone. Neither do they care to stay longer than a few weeks at a time, unless they are given a chance to return to their homes at occasional intervals. Moreover, most of their knowledge of the country has been acquired while hunting or trapping in the winter, so that in many cases they know of the existence of creeks and lakes, but do not know the link connecting them. Their natural instinct is frequently an excellent guide in itself; but usually, when an indian once passes out of his familiar surroundings he does not care to rely on instinct, but decides to be sick or something else as an excuse to be sent home just then. The explorer must do a great deal of work ahead of the line and frequently the information supplied by him aids the transport very materially.

The method followed by the writer in handling the transportation across long stretches where man packing has been necessary may be described as follows. The first thing required is as accurate a knowledge as possible of the distance across the next water route; from this the probable time required to produce the line across can be estimated, and hence the amount of supplies necessary to bring the survey within touching distance of the next waterway. The last camp would be made on the last waterway, and here all dunnage, camp equipment and supplies would be cut down to those actually needed in making the crossing, everything unnecessary being left with the canoes. On the morning after the cutting had reached a point from 1 to 1½ miles ahead of camp, every man on the party other than the packers would carry his own bedding and dunnage to the end of the cutting where they would leave their packs and go on with the regular work of the survey. To a member from each tent would fall the lot of carrying in addition their sleeping tent, which was made in every case of sail silk so as to be as light and compact as possible. The packers with the cook outfit and the cook and cookee with their dunnage, etc., would go on ahead a distance of probably 1½ to 2 miles where they would set up the new camp. Some of the packers would then return to the last camp after their own dunnage and those portions of the cook outfit that could not be carried the first trip, while the others would go back to the end of the cutting to bring up the men's dunnage and the tents, and pitch these at the new camp. It was found that five packers, with the aid of the explorer could handle the outfit in this way. From this time until the next moving day the packers would be busily engaged moving supplies on ahead of the camp, the object being to have the supplies ahead rather than behind the camp. When the survey has proceeded to a point where another move will bring the camp to the edge of the next waterway, the packers are sent back to bring the canoes around, by probably a very long detour, to the next crossing of the line. This is the general practice followed, but the details must depend for their development on the actual conditions. It should be apparent to even a casual observer, that the success of this system of transportation depends almost entirely on a knowledge of the existing water routes. For economical work it is essential that only enough supplies be carried along to bring the party within touching distance of the next waterway, and also that plans be so made that the axemen and linemen will lose no time from the line other than that lost in carrying their dunnage and bedding to the end of the cutting each moving day.

(*Winter Work*).

If the survey is to continue from summer into late fall and winter, other means of transportation must be arranged. The question at once arises as to what transport is to be used, horses or dogs. To go into a consideration of the relative merits and costs of these two classes seems unnecessary, as these points have been very well covered by Mr. J. N. Wallace, D.L.S., in his report of 1907, and by Mr. E. W. Robinson, D.L.S., in his report of 1910-1911.

It is the writer's belief that other factors are really the determining ones in the choice of the proper transport. The first of these factors which demands the consideration of the surveyor is the character of the country and the depth of snowfall. If snow is very deep the question of horse transport is out of the question. Dogs, on the other hand, can be used in practically any depth of snow, since a couple of men may be sent ahead on show shoes to open the trail, and after a day has elapsed their tracks will be sufficiently hard to carry dogs. In a comparatively open country the trail, crossing as it naturally will, different lakes and open swamps, will (in the case of dog transport) soon build up so as to produce an excellent trail. If horses are used, however, the trail drifts full of snow each time and has to be broken afresh at each trip. For these reasons dogs are to be preferred in open country where snow is deep, while horses will probably be found more satisfactory in bush country. If the country is very wet and much broken by muskegs and lakes, there is little doubt but that dogs should be used, since the swamps and muskegs and some of the rivers do not freeze hard enough to carry horses until about the first of December. On the other hand, dogs can be brought into the country in canoes and located at a convenient point so as to be available as a means of transportation as soon as there is sufficient snow for toboggans. In the season of 1913, owing to a heavy fall of snow which came about October 10th, and remained, the muskegs were prevented from freezing until about the end of November. The waterways began to close up as early as October 12th, and by October 20th many of the larger lakes were passable for dog trains. It is evident therefore that a surveyor using horses would have been compelled to either man pack throughout the last 15 days of October and practically all of November, or else lay up until such time as he could use his horses. With dogs, however, it was possible to push right ahead with the survey. One trip across the swamps on snow shoes, to pack the snow and spoil it as a non-conductor of cold, followed by one or two cold nights, produced a trail that the dogs and toboggans could travel over in safety. A second important factor in the choice of transport is the question of feed. In the northern country, where there are numerous lakes teeming with whitefish, tulebee, jackfish and suckers, the problem of dog feed is not difficult, if properly handled. In the first place accurate information should be obtained as to the best lakes for winter fishing, and also as to the kind and size of fish to be expected. Possessed of this information, the surveyor is in a position to put in a couple of fishermen, who, supplied with nets of the proper mesh, should soon be able to catch enough fish for the season if they apply themselves diligently. Any suggestions from Indians as to the best location for nets are frequently of considerable service. It is, however, a mistake to rely on Indians to do winter fishing, for with them almost always, necessity is what determines their activities, and they don't always recognize necessity when it comes along. Neither is it advisable to rely on the Hudson Bay Co. for a supply of fish, so that the wisest plan for the surveyor is to rely on his own arrangements for a supply of dog feed.

Last season the writer left two of his regular party on Setting Lake, with about 10 fish nets, and during about 40 days fishing through the ice they were able to put up very nearly 4,200 fish, chiefly whitefish. Horse feed, on the other hand, is more difficult to obtain, since hay is found only in very widely separated spots in this morthern area. This means that all the hay and oats for horse feed would have to be brought into the country, thus increasing the regular transport.

In regard to the efficiency of a good dog transport, the writer will be pardoned for citing a few facts relative to his work in 1913 and 1914. From October 28th, to January 5th, sixty miles of base line were surveyed. The transport consisted of 28 dogs, which were made up into five five-dog trains, and one three-dog train for the first six weeks. For the balance of the time just five trains were used. Supplies were drawn from a single cache located about seven miles from the commencement of the line and, on Setting Lake, at a distance of about 12 miles from this point, was located a single fish cache from which the dog feed was hauled.

Four dog drivers handled the transport, using the spare dogs in turn with the dogs of their regular teams, except on moving days, when the explorer and the cookee drove the spare dogs as extra teams. With a transport of this size it was necessary to arrange the trips after supplies and dog feed so as not to interfere with moving days, in order that the work on the line should suffer no delay.

A remark or two regarding the proper dog feed may be found of service. On the work each dog was fed two fish, mostly whitefish, a day, and at the close of the season were in excellent condition. When the dogs were taken into the work Spratts' dog buscuit was used; and whether the feed was unsuitable or not, at any rate they failed steadily. It is probable that biscuit might prove to be excellent feed once dogs become accustomed to it.

However, if the survey is organized in the early winter, horses might be found to be more economical and more satisfactory than dogs. Mr. E. W. Robinson, D.L.S., after using a combined transport of dogs and horses, during the winter of 1912 and 1913, on the survey of the Second Meridian, favours horse transport. There is, however, a serious objection, and it is that the scarcity of feed in the country makes it necessary for the horses to be sent out before the spring break-up. This arrangement leaves a very short season or necessitates considerable man packing before canoes can be used as means of transport. Dogs on the other hand can be used much later in the spring, as there is no need to send them out until after the break-up.

In conclusion, it may be pointed out that in no other district where base lines are being run today, is an accurate knowledge of the waterways so necessary. It has already been stated that Indian guides who are familiar with the country are difficult to obtain. A single explorer cannot be expected to trace out every watercourse far enough in advance of the survey to be of the greatest service, and for this reason the canoe men should be made to assist the explorer as much as possible in exploring the likely routes. It is therefore recommended that a second explorer be allowed with parties working in this district.

Transportation facilities may be such in many places, that the five or six packers, which the present party allows, are sufficient for all practical purposes. On the other hand where long stretches occur without water routes, they may be such that this number of packers is entirely inadequate for the work in hand. In view of this fact a second recommendation is made, namely, that two or three extra men be allowed to each base line party working north of Lake Winnipeg.

Mr. Aylsworth: After this very interesting paper, is there anyone with questions they would like to ask Mr. Herriot?

A Member: Yes. I should like to ask what is the size of a base line party in men?

Mr. Herriot: Twenty-one men including surveyors and packers.

Dr. Klotz: This paper recalls memories.

Major Hubbell: Mr. Chairman, I would like to be enlightened on one or two points, upon Mr. Herriot's very able paper. Such a paper is of value to every surveyor, particularly so now in view of the distance of transportation to survey work in the north. Mr. Herriot refers to summer and winter surveys. He does not specify spring or fall surveys. I notice we have several papers on transportation and the gentlemen, or most of them, have confined their remarks to summer and winter surveys, and there is no doubt that summer and winter work does not include all seasons. There is the spring of the year for instance, which do you classify that as?

Mr. Herriot: Winter.

Major Hubbell: Very well. But there is a great difference in the spring and the extreme winter, and in the summer and the fall, as any surveyor understands. Now I would like to ask for the information of the surveyors in general, a description from Mr. Herriot of a York boat, I mean the length of the boat, how many it will hold, the draught, how many men it takes to manage it, and how much freight it will carry?

Mr. Herriot: Mr. Chairman. There are some of these facts that I can give, but to give a full description of the York boat is perhaps beyond me. It is very much like a large skiff, of larger capacity, and is built so as to come to a sharp keel rather than a flat bottom like a skiff would have, and its probable length would be somewhere round 25 feet with a beam of probably eight to ten feet. It is wide enough for the men to have to use oars as long perhaps as 16 feet, and each oar rests on the opposite side of the York boat to which the Indian sits. As they row they rise up from their seat to a standing position and then fall back. The capacity of the boat is between four and five tons. They are built very strongly because they use them to run the smaller rapids with. They run rapids up to four and five feet, providing the water is deep enough. I made a trip from Norway House to Cross Lake in 1912, and in that trip we travelled over five rapids, the largest of which was six feet and the next five feet eight inches. They ran the rapids without lightening the boat at all. As soon as they approach the rapid they give the boat as much speed as possible, so as to give the steersman to swing the York boat as it shoots through the rapid. At the bigger rapids they lighten the boat by about half the load and then run it, and the other part of the load is taken on by portage. Frequently when going over these rapids, the boat swings round so that instead of pointing upstream, it would be pointing down stream. The number of men needed is nine, eight employed at the oars and one as steersman. I might mention that these men, being Indians, are prone to take advantage of everything that nature has to offer. If the current is strong, then all like to lie on their oars and let the boat drift. If there is any kind of a wind, out comes the sail and up goes the mast, and they rest for half an hour and finally decide there is no wind. This takes place ten times a day. The draught of the York boat is about four feet.

Major Hubbell: I thank Mr. Herriott for answering my questions the reason I asked them, was for the information of those who are not conversant with the details of a York boat, and I think surveyors cannot be too well informed on subjects of this nature. Now, my friend Dr. Klotz knows about these things of old, he has had some experience with boats of various sizes, and I have a fair knowledge myself. Mr. Herriott says that a 16 foot oar is necessary; this strikes me as rather long. Are half breeds of use in managing these boats? I notice a gentleman present who has had considerable experience on the Athabaska River, with Peterboro canoes, I would like to ask Inspector Lonergan for an expression of his views on the relative value of these canoes compared with the York boats.

Inspector Lonergan: The Peterboro canoe is about 19 feet long, and will carry about 1,500 pounds, three men are needed to handle it in sufficient water, and you can run pretty nearly any rapids with that. The Peterboro canoe does not approach the Chestnut canoe for a moment, and will not become waterlogged in rough water. In the Peterboro you are up against the other proposition. I have used the Chestnut for the first time in the fall of 1904, and I think the Chestnut the superior canoe, and the 18 foot Chestnut will carry more dunnage, ride the water higher, and is a better storm boat.

Dr. Klotz: Thirty years ago, when I made the survey from Medicine Hat I had two Peterboro canoes, one 19 feet and the other 17½. These canoes were made of bass wood and I found them easier to mend than chestnut or cedar. The natives, when we left Norway House, shook their heads because they had never seen a Peterboro, and thought we could never get through.

A MEMBER: The Chestnut canoe is a canoe made by the Chestnut Company. It is a canvas covered canoe and if you carry a pot of glue and canvas you can mend it more rapidly than any other canoe.

DR. KLOTZ: Oh, I see, I thought is was a chestnut canoe.

MR. AYLSWORTH: If there are no more questions I think we should give Mr. Herriott a vote of thanks for his paper.

DR. KLOTZ: As an old surveyor I have very much pleasure in moving a vote of thanks to Mr. Herriott for his very able and most interesting paper.

DR. KING: I have had no experience and I cannot say much about such matters, but I recognize that this paper is the kind of paper which is most valuable for a session of this kind. I shall join in this vote of thanks with much pleasure.

The vote of thanks was carried and the meeting terminated.

ANNUAL BANQUET.

The Annual Banquet of the Association was held at the Chateau Laurier on Tuesday evening, March 3rd, 1914, and was pronounced the most enjoyable social affair yet held by the Association. It was the first occasion on which the festive board has been honoured by the presence of the Minister of the Interior. Hon. Dr. Roche, in a pleasing after dinner speech, delighted all present and by his own evident enjoyment of the occasion, it is hoped that he will be present many times again.

The thanks of the Association are due to those gentlemen to whom the great success of the evening was due, and it is earnestly hoped that every member that can possible do so will avail himself of the opportunity and privilege of attending future banquets, as by this means, more than any other, the members are made acquainted with each other and with the department as a whole.

Dr. W. F. King, C.M.G., D.T.S., presided in a most satisfactory manner.

He said: I have received apologies from the following gentlemen:—Dr. Chabot, M.P., Hon. Frank Oliver, M.P., Mr. J. S.

Dennis, D.T.S., Mr. J. G. Turriff, M.P., Mr. J. E. Sirois, President of the Association of Quebec Land Surveyors; Mr. R. H. Campbell, Director of Forestry; Mr. J. W. Greenway, Mr. W. J. Stewart, Mr. W. W. Corry, C.M.G., Mr. J. A. Coté, Mr. C. A. Magrath, D.T.S. I also have to say that my presiding here this evening is due to the unfortunate illness of Mr. J. J. McArthur, who was to have presided, but who was taken ill suddenly to-day, and that is the reason I am in this chair. Let me propose the loyal toast of His Majesty the King.

THE KING.

DR. KING: Now we drink to our country, and with it the House of Commons of Canada, which represents and is in one sense the country itself. You know those men who are sent to Parliament, the idea is that when they are representatives of constituencies, they will lose within the walls of parliament their own names and patronymics and becone known by the names of their constituencies. We have several of these gentlemen here this evening, from whom we hope to hear. We have Hon. Dr. Roche, Minister of the Interior, Senator Casgrain, Dr. Thompson, of the Yukon, Mr. McNutt, Mr. Clements and Mr. Taylor. We therefore, in drinking this toast, will testify to our approval of the manner in which Parliament is conducted generally, not from our own point of view, but from the point of view of the country. We believe their policy in regard to surveys has been that they are of special and general value. I will ask you gentlemen to drink to the Parliament of Canada, coupled with the names of Dr. Roche and the others here this evening.

DR. ROCHE: A little more than a year ago I had the honour of receiving an invitation to your then annual banquet. I accepted the same, but unfortunately before the time arrived for holding it, I had to submit myself, not at the hands of a Dominion Land Surveyor, but at the hands of an M.D., and so successful was he in his exploration that he located a stone quarry in my department of the interior, and I was fortunate in being able to dispose of all my legal right, title and interest in the same before leaving for home, and I assure you I never parted with anything with less reluctance in my life. (Laughter). I thank you for the privilege of being present at this banquet to-night, and I think it is due to every Minister of the Crown to avail himself of every opportunity to meet with the service generally, but more particularly to meet with his own department in order that he may acquaint himself more thoroughly with the work performed, so that he may place himself in a better position to discharge his duties as head of the department, and that he may do his share in establishing those friendly and harmonious relations between chief and staff that are essential to bring about the best results, departmental and otherwise. With this object in view, therefore, it is a pleasure to me to be present to-night. Ever and anon in the history of individuals, of societies, of organizations such as your own, or of cities or nations, occasions arise of more than passing improtance, because they are commemorative of some notable event for instance the great country to the south of us celebrate annually each return of its day of Independence. The 24th of May reminds us Canadians of our former beloved Sovereign Queen Victoria, whose memory we still honour and revere and which is set apart as an annual holiday to honour her memory. The First of July comes home to every Canadian reminding him as it does of the commencement of that great epoch in our history when the great forces of Confederation were welded into one mightier whole. England has her St. George's Day, Ireland her St. Patrick's Day, Scotland, her St. Andrew's Day, each commemorative of her patron saint. And so I might go on till I come to your gathering this evening. Those who are met here to-night, those engaged in field work, blazing the trail for the early settlers, frequently enduring trials and privations, as well as those who are engaged in the clerical work, dealing with the results of the operations of the outside staff, all mingle around the festive board and by social, musical and fraternal efforts succeed in passing a few hours, the pleasure of which will be felt for months to come and which is looked forward to by months of pleasurable anticipation. You have done me the honour of associating my name with the toast of the parliament of this country. Now parliament is engaged in speaking for itself, and the curious observer who desires to acquaint himself with it has simply to walk up on Parliament Hill, take his seat in the gallery for a greater or lesser time, according to the inclination of the individual, and watch the parliamentarians in action, the manner in which their work is performed, and he will form his own opinion as to the parliament of our country, and while he will see that we have divergent views on questions of policy and on matters of detail, I trust he may also observe that each has at heart the advancement of this our common heritage, and while our parliamentary institutions are open to legitimate criticism they are, I think, quite comparable in a most favourable way with any other country where such parliamentary institutions exist. It is true we have a party form of Government. It is true that party government has its draw backs, but wherever a different system of government has been tried, abuses as great and even greater have arisen, so that in my judgment, for a country situated as Canada is, the party government is the more favourable. At any rate no better system has been devised up to the present. I do not consider that all questions of importance should be dealt with from the point of view of party struggle. There are questions that arise and should be treated above party lines. There are questions that Canadian politicians have had to grapple with, very many questions of national importance, and they have shown their ability to carry those questions through to a successful issue. What they have done in the past I am sure they are equally able to do in the future. There is one question of very great importance, and that is with regard to the people who come to make their homes in Canada, people of different races, of diverse nationalities, people whose training, whose environments are so different to our own, these people come to us intent on carving out for themselves, homes and careers on Canadian soil. I was asked on more than one occasion if there was not danger in having so many foreigners come to take up their homes, particularly those coming from the great republic to the south. My reply was that a great many of those coming from that country are returning Canadians, people who were attracted to that republic when our Canadian northwest was an unknown quantity. Many are the sons and daughters of these people who are desirous of establishing themselves in the country of their fathers, many of those who come are those who originally came from the older countries, have spent a few years in the United States, have acquired holdings and have disposed of them, and have come to make their investments in the Canadian northwest, and many come from countries whose interests, whose laws and institutions are not so dissimilar to our own. These people come to Canada, they see under our laws how very progressive they can be and how they are respected, and soon they join with us in building up a strong Canadian nationality. We have a country of which we can be justly proud, and when the traveller leaves the boat and takes train and travels through the smiling valleys of the maritime provinces, he begins to see what kind of a country he has come into. Then into the wonderful province of Quebec with its diversified interests, and then into the Province of Ontario with its manufacturing interests, with its enormous hinterland where millions have been abstracted from the earth, until we reach Winnipeg, the gateway of the west. Then he goes hundreds of miles across the prairie, the greatest potential wheat fields of the world. Elevators dot the traveler's line as he proceeds through the west to those great magnificient Canadian Rockies. Great and grim these wonderful phonomena of nature stand out in still and striking splendour after miles of prairie have been passed, and as the train rushes down this steep grade or climbs up a forbidding path among the dark mountains and winds in and out tunnels, it seems to the traveller that the work of men's hands is as remarkable as the scenery is wonderful. And so he goes on till he comes to those splendid cities of the coast, Vancouver, New Westminster, represented by my friend, Mr. Taylor, and where you will see a Province that is even more optimistic than those you have passed through. I know the representatives of every province consider their's the wealthiest and the finest province of the Dominion, and I think it is a splendid characteristic of any people to show such optimism as is so marked in our western provinces. And that traveller will have come to the conclusion that Canada, properly governed, will yet be one of the most progressive countries of the universe, but of course I must emphasize that word "properly governed." Mr. Chairman, I do not wish to take up any more of your time, save to say this. I have the honour of being at the head of the Department. The most of whom are gathered here to-night, are under that Departemnt. Anything I can do to further the interests of the Interior Department, either in the Department or the country, will be done, and my services will be at the disposal of those who would require them, and when I look around and see old war horses such as our veteran chairman and Dr. Deville, I think my duty will be lightened very much by the knowledge of such competent men at the head of their branches and under whom you gentlemen are pleased to render efficient service. I thank you once again in asking me to be present with you and I wish all you surveyors all the progress and prosperity which I am sure your merits so richly deserve.

Senator Casgrain: Mr. Chairman, Mr. Minister, and fellow land surveyors, I do not know whether, to-night, I am a land surveyor or a senator, or whether a Dominion Land Surveyor or a Quebec Land Surveyor. I am almost overawed by the honours being done us, and I myself have always been honoured by an invitation to your dinners, but I think this is the first occasion that the dinner has been graced by the presence of the Minister of the Interior. (Cheers). If there was any doubt as to how the Dominion Land Surveyors were doing in the world, this is good evidence that they are getting on all the time. There is quite a long programme and you will pardon me if I am not very long in my remarks. Let me say the Chairman of the Association of Quebec Land Surveyors is Mr. Sirois, and at his special request I am representing him here this evening, and that is another qualification I have for being present. It is a great satisfaction to know that you have a minister who takes such a lively interest in the profession. He knows the geography of the country perfectly well. He has taken us through every province, and he has already spoken of the hardships that we surveyors have to go through. I hope he will remember those words. I know he is not looking for votes. (Laughter). It will really be a pleasure on some future occasion when we have to go before the government of this country to ask for better terms, that we know we will have a gentleman at the head of the Department who will understand what it means, who will realize for a surveyor what it means to be introduced about once a year to his own children. (Laughter.) I have been told that many surveyors who are on lengthy surveys have come home for a few weeks in winter time and at that particular period of the year their grown up children are at College. The boys and the girls grow up and after two or three years are men and women before the poor surveyor sees them. Hardships of that kind certainly deserve a good reward I have had part of my good reward but at that time I had no children. The Minister has just touched upon one subject. It is a fact that we have foreign races and also people from the other side of the line arriving daily in very large numbers. In a former administration I called attention to the fact that I thought it would be wise to disseminate these people. We like our brothers of the United States. We like them to become good Canadian citizens, but I think it would be well to intermingle them with the other people so that you know there are no separate localities where there are settlements composed entirely of people coming from the other side of the line where life is different and where yet they keep up their interests and read the newspapers of their own country, and keep up their interest in it. I think it would be well (and this is perhaps a little serious), that they should try and mix them up with the others and make good Canadians of them. This is only *en passant*. The Province of Quebec has an Association of Land Surveyors, and if I may be permitted to remind you, I do not think there is any other province where the surveyors are as prosperous. We have managed to secure several things which the surveyors in other provinces have not got an exclusive right to do, and many of us have offices in the City of Montreal, where several employees are engaged under one surveyor and drawing in for that surveyor nice return at the end of the year. You see we have managed to delegate our powers, and we have people that we employ to do our work, and we come and spend a most pleasant time here during the session.

Now the Minister was speaking just now of parliament. Of course you know there are three branches of parliament, the Governor General, now His Royal Highness the Duke of Connaught, but they come and go. You have the House of Commons, but they come and they go also, for four or five years, but they go, but there is one house that is there always. That is the Senate.

We are always there, when the Governor Generals are removed when their term of office expires by the operation of the Imperial Government, when the House of Commons is removed by the operation of the electors of the country, but the Senate, God Almighty alone can change that. It places us on a much higher sphere than the other two branches. We may work without expecting any reward here below, we may work as we think in the very best interests of the country and the very permanency of our tenure makes us independent of any passing whim of popular caprice. We are therefore the guardian of your rights and I myself have appointed this present speaker the guardian of the rights of the Dominion Land Surveyors. (Applause). Whenever there has been legislation coming up I have watched it. I remember a few years ago, the then administration wanted to admit all surveyors throughout the empire, that is, the surveyors of Australia, and just then there were a lot of them doing nothing in South Africa, and they would all have been admitted here. That bill came to the Senate Chamber and there, with Senator Kerr and myself—talking of land surveyors reminds me now that Sir Wilfrid Laurier's father and his grandfather were land surveyors—and although the surveyor-general was acting under the instructions he had received, we trimmed that bill to a finish and no surveyors were admitted. There are enough of us to do the work that is put down here. I desire to thank you most particularly for inviting me again this year, and I have a message from the land surveyors of Quebec. They wish you all good fortune, they wish you to go as far as possible and survey as many townships as you like, and they will not interfere with you because they have better work to do at home that pays them better. (Applause).

Dr. Thompson: I desire to thank you one and all for doing me the great honour of inviting me here as your guest this evening. I had the same honour a year ago, and I am glad to be with you again this evening to enjoy this occasion. Since we last met one or two things have happened in Canada, one in connection with the territory I have the honour to represent. We have had the completion of the survey of the 141st meridian, which is the boundary line between Yukon and Alaska. That is of considerable importance, in fact of vital importance to us in the Yukon, but being so far away from here it does not occur to you so important as it does to me. The completion of that work was in the hands of Mr. J. D. Craig. For many years a party of Canadian surveyors laboured in delimiting the 141st meridian, and now from Mt. St. Elias to the Arctic Ocean, the line is surveyed. It is very important to us: The United States have settlements on the Alaskan side of the boundary as we have on the Canadian side.

These settlements are side by side and as new discoveries are being made from time to time it is very important that this line should be definite. It is very satisfactorily settled to both countries.

You have done me the honour of associating my name with the toast of Parliament. As Dr. King has so well said, the Parliament of Canada is really the people of Canada. Let us turn our attention for a moment to the origin of this institution. The free institutions we enjoy today are nothing new. When they were first assembled at the mouth of the Weaver the Anglo Saxons had a parliament. The principles were the same. They had their meeting tree around which the clansmen met and when they emigrated to the British Isles they brought those institutions with them and eventually they evolved into that mother of parliaments which to-day stands as the most magnificent of all parliaments. It is the mother parliament that has given parliaments to all the colonies and the congress to the United States. Thus Parliament is the true reflection of the opinion of the people of Canada. It is the mirror in which the public opinion is reflected. It is the crucible in which public opinion is turned into laws and there is given the authority that carries out the desires of all, the people to govern themeslves by men elected among themselves. We believe that we represent the people and we try to make laws which we believe are the reflection of the opinions of the people. This parliament of ours has served us in good stead and so it will as long as we maintain those principles of freedom and justice. (Applause).

Mr. McNutt: Mr. Chairman, Dr. Roche and gentlemen, I do not know why I have had the honour of an invitation here except that perhaps it is on account of having been associated with surveys in the early days, as Dr. King, I think, will remember. I had the pleasure and honour of being under canvas with him for something like two years in the early 70's. I thought as Major Hubbell had invited me, he did not want me to give him away, because I met him West some twenty years ago. There is one thing and that is when you get among a lot of surveyors, young and old, you get amomg a lot of good fellows. You seldom get a lot of fellows undertaking the hardships you do, and any snobbery amongst you is soon knocked out. You can always feel that when you meet a surveyor, you meet a good fellow.

The toast is in connection with the Parliament of Canada. I notice that all have avoided that subject. The Minister invited you to get into the gallery to know how parliament is run and what it is doing, and I will follow his example and not say very much about it. But there are one or two things that I will take a little time in outlining in connection with the profession. I am rather surprised to find so many young men. The profession must be in pretty good shape. Years ago there was a good deal of work done in the west away ahead of settlement, and somehow or other the work petered out. The work was done so much ahead of settlement that when the settlers came into the country, the marks had absolutely gone and they had to be outlined again. This would make a great deal of work, and I am glad to find that the profession is today attracting so many young men, as it is one of the finest in the world. Something has been said with regard to our foreign population. I am in a position to say something about that. I think they are becoming assimilated. Let me hold your attention while I give you an instance from the district I represent, where there are a number of foreign settlers, not so many as in some others, however, I don't know if I have even got as many as Dr. Roche. I have taken some little interest in these people. I knew the first thing to be done when we had the people was to get good schools among them. There was some little difficulty, but it was managed and two years ago I was invited to attend a union picnic composed of eight foreign schools, and I would not have missed it for a great deal. Three hundred children were there and were grouped, and each one carried a Union Jack in his or her hand. They were called upon to recite for prizes, and I can tell you, gentlemen, none of you ever heard anything better done along those lines than on that very platform. These scholars were composed of children of people from Austria, Germany, Poland, Hungary and other European countries. I had to make a few remarks and I told them just what I felt. I told the parents they should be proud of their children and the children should be proud of their parents. They had come to this country without knowledge of the language and had accepted the conditions they found and the children who were there on that occasion—well you could not say they were not Canadian children. You could not find in any locality a better, finer, better behaved lot of children. So I think there is no danger that the foreign born settlers will not assimilate with our population. I find the older people look upon it in this way. They have come to a free country they find that all they have to do is to behave themselves and respect the institutions of the country and I believe they would be willing, if necessary, to turn out and defend the country, now theirs, with the last drop of blood in their bodies. I will not delay you any more, but I will thank you for the pleasure of being here on this occasion.

Mr. Taylor: Just a very few words to express my thanks to the Dominion Land Surveyors for this opportunity of meeting them among old friends of the association and of seeing the rising generation. As Dr. Roche told you a little while ago, parliament speaks for itself. Unfortunately I am out of practice, as it is some time since I had a speaking part in parliament, but you will excuse me, I am sure, when I say it is because I have the good fortune to sit in the House of Commons behind your Minister. So that when he has been heard, there remains very little for us fellows to say. I would like to say this from British Columbia, that I think we afford a better prospect for Dominion Land Surveyors than any other province in Canada, because great as some of them are, out there we realize that we have sçarcely touched on the fringe of that wonderful province. There is something to the north of British Columbia, as I have heard Dr. King say in Victoria. We have a well defined line down south, but north, all that lies beyond half a degree of the C. P. R., is a terra incognita for you gentlemen to conquer for us. All I have to say is that some of you gentlemen ought to come to British Columbia and endeavour to help us in opening our great hinterland.

Mr. Clements: Veteran chairman and gentlemen, I am sure I want to thank you for the very great honour and the very kind invitation to be with you, and I regret I was not able to attend your banquet last year. Permit me to offer an apology for Mr. R. B. Bennett, who also accepted your invitation. Mr. Bennett asked me to explain to you that he had been called away on an important appointment and was therefore unable to be present. There is no man present here that has a greater respect for your chairman than myself. As a young man, coming here many years ago, I was invited to the observatory. I was then one of the youngest members of parliament, and we went out to look at the sun, moon and stars, and also some scotch whiskey, and I am not sure we didn't see several moons and stars before we returned. But I certainly appreciated the invitation of your chairman. I notice in this gathering many young men. I am rather an old one myself, and let me say to the young men, as far as your profession is concerned, as Mr. Taylor of New Westminster has said, and Dr. Thompson, even further north than is my constituency, there is a great field in British Columbia for your profession, and I say to every young man, "Go West." Go to the Yukon. Go to Northern British Columbia, and there is a great field for you. I was glad to hear of Mr. Craig from Dr. Thompson, and if I may say so, I want to express a similar opinion, as Dr. Thompson has expressed of Mr. Craig for his work in the Yukon, for Mr. N. J. Ogilvie, for the work he has accomplished in my constituency. So far as the constituents in that northern country are concerned, either Liber or Conservative, Mr. Ogilvie is held in their highest regard and respect so far as his ability and his work is concerned. I am a Canadian, first, last and always, and a British subject I always shall remain, and I wish that your profession may increase and that every one of you may attain to what you most hope to accomplish.

Dr. King: I wish to remark that the future progress and prosperity of Canada to which we all look confidently forward, lies in the northwest, and as the basis of all progress, all wealth lies in the land, the most important thing in the first instance is the division of the land, that the land shall be divided rightly. So we come to the next toast, which is of particular interest to our profession; and the branch I refer to is one of the most important in the branches under the Minister of the Interior, or of any branch under the government. I refer to the Topographical Surveys, and that is the toast we will drink, coupled with the name of the Surveyor-General, Dr. Deville.

Dr. Deville: It is my duty as well as my very great pleasure to tender my thanks to the speakers for their very kind remarks about surveyors, and particularly to Dr. Roche, who on this occasion has shown his great sympathy for us. Surveyors are very fortunate in having for Minister such a man as Dr. Roche, a man who knows their work and who has never lost an opportunity of showing his sympathy. These expressions of good will are especially appreciated by us because there is a good deal of misconception about surveys and surveyors. I may illustrate that by a conversation I had with a gentleman who was telling me the trouble he had with his son. This gentleman is a barrister with a good practice. His first idea was to get his son to study law and then to take him into partnership. The young man was not very bright and could not learn, so the father gave up the idea of making a lawyer of him. He tried him in other occupations, but he was not a success; the work was too hard for him. As far as I could make out, the main characteristic of the young man was a decided aversion to work of any and all kinds, and so his father concluded that the only thing that could be done with him, was to send him on a survey. I had another conversation with a gentleman, also of the legal profession, who didn't approve of our methods. and who came to tell me so. He thought we took too much trouble with surveys. There was no need of making them so well. I was observing that it didn't seem quite right that a man who had a patent for 160 acres should only get 100 acres. He said, "My friend, what he gets does not matter. If he believes he has 160 acres he is just as happy as if he had them." So on the one side you have the opinion that the surveyor has not got to work, and that he does not need to know anything. On the other hand you have the opinion that any kind of survey is good enough. I am not going to discuss these matters now, it would take us too far, but I would like to give you a few facts and figures that show surveyors have done some work. The surveys were commenced in 1869, and at first they proceeded rather slowly. When I took charge in 1881, the surveys had just reached the boundary line of Manitoba, and their cost was a million and a half. Since that time the surveys have reached the Pacific coast and the Peace River, and we have spent fifteen and a half million dollars, so that today, the cost of the surveys has reached seventeen millions. To date we have surveyed about 7,800 townships. Of course we have done other surveys besides, but these townships are the bulk of our work. The trouble with these large numbers is that they do not represent anything to the mind. You cannot realize what 7,800 townships is. You can realize what a square mile is. If you walk from here down Elgin Street to the Canada Atlantic, that is one mile, if you go from here down Wellington Street to the Waterworks, that is another mile; you can figure in your mind the extent of a square mile taken as a piece out of the city of Ottawa. A township is a little more than 36 square miles; so that may give you some idea of what it is. But can you realize what 100 townships are? You cannot. The only way of getting any idea of what 100 townships is, is to compare it with something else. If you take the States of Delaware and Rhode Island and put them together, you will have almost enough land to make 100 townships. Now what is 1,000 townships. That is too big again and you have to make another comparison. Belgium and Holland are two mighty states with a population of over thirteen millions, but you will have to throw in a couple of kingdoms like Saxony and Wurtemberg to make 1,000 townships. With 7,800 townships put in a row, you have a strip six miles wide that will go twice round the earth. I am giving you these figures to convey some idea of the immensity of the work we deal with. Everything is on a gigantic scale. This is the work that surveyors have been doing; I shall now tell you the work they are doing at present. This year we have 80 survey parties in the field, more than 1,000 men. What they will do, of course, I cannot tell, but I can tell you what they did last year. We made base line, road and other surveys, but in addition to the ordinary work, we had to commence a peculiar kind of survey. Probably most of you know that the western country has been drying up. Many of the small lakes have become entirely dry and we had to survey the beds of these lakes. We made this new survey in 458 townships and we made complete or partial surveys in 440 townships, or about 900 townships altogether.

Everything we touch is of immense proportions. We have a large staff here; the number on the civil service list is 122. Sometimes surprise is expressed at the size of the staff and why it is so big; you may understand why from what I have just been telling you. The country is so immense that the least trifle becomes a great undertaking. Let me illustrate this by an instance of the last few days. We received a request for a number of plans from a Land Titles Office. We are obliged to furnish them plans; even if we were not, we have to keep on good terms because, if we did not, they could make things unpleasant for us by refusing to register our plans. So we had to send these plans. We sent those we had in print, but a number were out of print and these we had to make by hand. That looks like a mere trifle; you would not think anything of it; you will not think so when I tell you that we had over 500 of those plans to make by hand. Everything is of immense proportions. That work would take three men a year, and we have not three men to spare for any kind of work. We are not looking for work, we have more than we can manage. There are nineteen so called departments of the Government, but other organizations are to all intents and purposes, departments. There is the staff of the House of Commons, the Privy Council, the Senate staff and so on. If you count these as departments, there are thirty-one departments of the Government. Leaving out the Interior, only six departments are larger than the Topographical Surveys branch. That gives you some idea of what the surveys of this country are.

SISTER SOCIETIES:—Replied to by—

Dr. DeLury, of the Royal Astronomical Society.

Mr. Geo. Mountain, of the Society of Civil Engineers.

Mr. L. V. Rorke, of the Association of Ontario Land Surveyors.

Mr. James White, F.R.G.S., Assistant Chairman of the Commission of Conservation.

Recitation by Mr. R. O. Spreckley.

"GOD SAVE THE KING."

OTTAWA, MARCH 4TH, 1914.

MORNING SESSION.

Mr. Aylsworth in the chair.

THE CHAIRMAN: I am glad to see so many here after last night's entertainment, and I trust we will see more out as the meeting progresses.

The first paper this morning is on "Transportation on Base Lines," by G. H. Blanchet, D.L.S.

MR. BLANCHET was received with warm applause and he read his paper as follows:—

TRANSPORTATION ON BASE LINE SURVEYS.

By G. H. Blanchet, D.L.S.

It will probably be agreed by all surveyors of base lines, that the most vexing questions with which they have to deal in surveying their lines, are those in connection with transportation. So little is known of the north country before the lines have been run, and its features vary so much, that, to a very large extent, difficulties can only be overcome as they are encountered. Experience gained during the survey of other lines is, however, of great assistance in pointing out certain broad rules which should be followed in most cases.

The means which should be used for transportation differ greatly for the different seasons of the year. They are therefore best classified in reference to the periods of the year considered. Taking these periods in the order of time in which they usually occur, we have to consider (1) Location of Caches; (2) Spring transportation; (3) Summer transportation; (4) Late Fall and Winter transportation.

Caches should be arranged on such a basis that as the actual survey of the line is being carried on, not more than two trips of the transport outfit shall be needed to carry everything forward from each cache. There is then sufficient time between successive moves of the main camp to allow everything to be kept up with the camp. This avoids the necessity of having an extra supply train working independently of the camp to bring up supplies. Such an extra supply train generally gets into difficulties caused by deep snow or floods, or the break-up of ice in rivers or lakes, or the thawing of the ground in the muskegs.

It is the writer's experience that two trips of the outfit should be able to carry on supplies for three months. This should represent at least 60 miles of line surveyed. If, therefore, caches are placed about this distance apart along the line, their location should result, under ordinary conditions, in enabling the surveyor to utilize their advantages to the best account. On one hand, he does not need to have an extra supply train with all its attendant worries, and on the other, he has avoided the expense of additional caches by placing the ones he has as far apart as the fullest use of his camp transport will allow.

As regards the number of horses which a surveyor should have, the present standard pack train of thirty-one horses forms an efficient mean between shortage and the trouble of handling too many.

In a well-cared for pack train of thirty-one horses, there should seldom be more than one or two incapacitated from work, but usually six or seven may have to be favoured with lighter loads.

The load a pack horse can carry depends more on the trail than on the horse. It is good policy, in the long run, to make a good trail. A pack horse should carry from one hundred and twenty to two hundred pounds on an average survey trail. The whole train of thirty-one horses should handle about forty hundred pounds of the bulky freight of a camp, and about fifty hundred of cache supplies, the latter being much more compact and much easier on a horse, weight for weight, than camp outfit. One trip of the whole pack train can handle the tents, beds, dunnage, cook outfit and in addition enough supplies to last for some days. Two men can handle the train, with the help on moving days of the cook, cookee, and one other man who should be the trail cutter. As the supplies get lighter, and the whole train is not needed for second and third trips, the packers can assist with the work of fixing trail. In bad muskeg the trail will often require repairing after one trip. While the horses are going back light for the cache a couple of axemen can put it in shape.

The writer is strongly in favour of keeping all the horses in camp, and not having a separate train working exclusively on the trail. When the horses are divided into camp and supply train, many objectionable features arise. Two more packers are needed. This means taking two men off the line, resulting in a decided loss of efficiency of the whole party. Camp can not be moved in one trip. The first section must be cut down to necessities, with the result that if bad weather prevents the horses going back next day for the remainder, great inconvenience may result. Then again a pack train working back on the trail may get into serious difficulties from being so short handed. A specific example is the case of a muskeg sufficiently frozen to allow the camp outfit to cross, but which might be thawed out later in the season when the supply train would have to cross. In general it is infinitely more satisfactory for the surveyor to have everything in camp where he can personally supervise it. Supplies in a cache represent so many horse loads, and in whatever way it may be handled, the same total transport will occur. It is true that when there is no train back on the trail, heavy work is entailed for the first moves forward from a new cache, but this is more than balanced by the comparatively easy time the horses have when the load gets lighter.

Expenses occurred in placing caches, though they may appear in themselves high, are usually justified if the caches are so placed that no time is lost when the survey party is subsequently at work. The value of a day, when the full party is at work, may fairly be estimated as running from $100.00 to $150.00, for if a day is spent in advancing transportation, instead of on the actual work on the line, it means the loss of a mile of line which would othersiwe have been run. The true way to estimate the loss of a day's work on the line in the middle of the season is not by considering only the actual day's wages and board account, but by dividing the total cost of the whole season by the number of days which are spent on the actual survey of the line. Time travelling from town to the locality and back again, Sundays and days of bad weather, all these must first be deducted before we get the number of days which are available at best for doing the real work we set out to do. It is not one of those days which could not have been utilized on the line which are used up in forwarding transportation in th middle of the season, but it is one of those days (much less numerous than the total) on which we could have advanced the line itself.

For similar reasons, namely, to save the party when actually on the ground for doing the survey work itself, it will generally be advisable to hire outside help and outside means of transportation to move up supplies, whenever a chance offers.

The location of the caches must depend, to a certain extent, on the topography of the country, especially on the nature and course of any large rivers. Where a Summer water route is available it usually affords the easiest means of reaching the line. If, however, such a route is not available, supplies are best transported either as soon as there is enough snow to use sleighs, or else towards the end of Winter when the snow is becoming light.

Early in December or early in March, is the best time, preferably the former as there is always more risk in spring. It is an absolute necessity when sending supplies out to be cached in an unknown country to send a responsible man in charge to see to the location, building of the caches and storing of the goods.

The chief dangers to which a cache is exposed, are water from rain or floods, large animals such as bears, and small ones such as squirrels and mice, and in recent years there has been the added danger of burglars. It is impracticable to make the roof and side of the cache proof against rain, so this is generally provided for by hanging tarpaulins from poles placed lengthwise inside the cache and close to the roof. With a pole under the middle of the roof, two poles under the sides of the roof, and two more about half way down the sides of the walls, a complete curtain can be formed to keep off rain which comes through the roof or splashes in at the sides.

It is comparatively easy to make a cache safe from larger animals, but it seems almost impossible to keep the small ones out. It is not possible to make a cache burglar proof, and the only way to protect caches is by the determined prosecution of any offender. Cases of robbery are becoming more numerous each year, but no prosecutions have yet been made. The serious part of such robberies is the inconvenience and sometimes danger which an unexpected shortage causes, apart from the financial loss. It is a fact which is not creditable to white men that such robberies only occur where they travel. Indians are usually scrupulously honest in this regard.

A good floor of poles should be provided in a cache to keep the supplies off the ground, and to prevent animals from digging their way in. The meat should be hung if it is intended to have the cache remain during warm weather, and especial care should be taken about the way sugar and dried fruits are stored. A trench should be dug around the cache. whenever possible to keep the bottom dry, and a certain amount of clearing away of the surrounding bush, and sand placed on the roof will decrease the danger from fires.

When the party is at work on the line, time and trouble will often be saved if someone is sent ahead, as the line approaches the locality of a cache, to find out its exact location and decide on the best means of cutting out trails to it.

The survey party now usually goes out to the work towards the end of Winter before the snow is gone, advantage being thus taken of Winter routes over ice and frozen swamp land. A serious item in this arrangement is the getting of horse feed. This has to be transported long distances. It is almost impossible to keep horses on oats along in Spring. The swamp grass has hardly any nourishment, and the horses are exhausted in digging down below the deep snow to reach it, such as it is. Twenty pounds of hay, or even less, with seven or eight pounds of oats per day. is enough to keep a horse in good condition, if he has a chance to rustle. Enough hay should be provided by some means to last till early in April, and enough oats to last till the middle of May.

It will generally happen that the loads will be getting light at the time when feed is poorest.

Good horses are a necessity for Winter and early Spring transportation, not necessarily big ones, but hardy ones and good fighters. It is good policy to have an extra horse for use in case of accident, and a few pack saddles will often come in useful. Whether three teams with sleighs or four are better for use in Winter is a matter of opinion. If much hay has to be moved, four sleighs are the best.

Transportation is very difficult during the period which comes after the sleighing has become poor, and before there is enough grass to use the pack train. During this period the outfit should be cut down to necessities, the remainder being cached in some suitable place. For moving camp during this period, two schemes are suggested. One is to take the rear bobs off the sleighs and shorten the rack, securing it in front to the roller. Although this is an awkward looking contrivance it is pulled fairly easily, and will carry a good load. The other scheme is to give up using the sleighs altogether, and to use the team horses as pack horses. With this last arrangement camp should only be moved so far each time that two trips can be made in a day.

From the time when the full pack train arrives in camp from the outside until well on in June, conditions of trails are usually good, though the feed is poor. There is enough frost beneath the surface of the muskegs to make a good road over them and very little chopping is required to make a trail.

About the beginning of June the frost beneath the surface finally goes out altogether in the tamarac swamps, and it has become weak in the spruce swamps. The laborious and disagreeable work of brushing the muskegs has then to be begun.

The duration of frost in the muskegs depends on the depth of moss on top, on the amount of surface water, and on the protection from the sun offered by timber. The effect of the moss is much the same as that of the sawdust used in ice houses. Surface water greatly hastens the melting of the underlying ice. In the case of tamarac muskegs there is little protecting moss, and usually much surface water, as this class of swamp is low, Consequently the frost fails first in small tamarac runs. It lasts a little longer in large tamarac swamps, but local weak places occur early where there are holes and these are dangerous and hard to fix.

The swamps covered with burnt spruce are the next to fail, as the surface is much exposed to the sun, but this same exposure results in soon drying up the surface, and the roots toughen, so that although travelling is heavy on the horses the ground does not require brush.

In spruce swamps where the timber is green, the frost lasts longer where the moss is rough and lumpy and the timber growing thickly, than where the surface is more even and the timber more scattered.

Placing brush on muskegs is work that no one likes, but which, in many parts of the north, is a part of the daily programme. Two rules apply to brushing. The first is to avoid it altogether, if it is at all possible to go round the muskeg, even at a considerable increase in distance. The second rule is, when it cannot be avoided, to do it well. A poor piece of brushing causes subsequent trouble and delay and serious damage to goods often results when a pack horse breaks through the brush.

It is a good plan to have the trail man travel with the horses as much as possible as he then learns what is necessary. Where small spruce trees are plentiful the best trail over a muskeg is made by using them. If no spruce is available, log corduroy must be used. This should be well pegged down, and either moss or soil should be placed on top to prevent slipping.

When cutting trails over soft ground, all windfall should be cleared right out, while on hard ground, it is only necessary to clear out enough for each step of the horse.

The presence of moose or caribou trails should be studied. These trails are generally the result of the moose or caribou bieng compelled, during their wanderings to converge from different directions to the locality of the trail. The more worn these trails are, the more it may be suspected there are difficulties in the way of travel elsewhere. When such trails cross the survey line at right angles, it generally means that a bad area of swamp, round which the trails are going, will shortly be encountered. A moose trail met with in a muskeg is generally heading for the nearest dry land. When looking for a passage across a bad tamarac swamp, if the direction of drainage can be ascertained it should be followed downwards, and oftener the swamp will narrow to a creek, while if any attempt is made to find a route by going against the drainage the swamp will probably get worse. Large timber, or timber growing thickly, usually indicates shallow swamps, while small and scattered trees mean that the swamp is deep. A feature noted, but not explained, is the way that dry ridges usually cross the line instead of following lt.

The feed for horses begins to get poor about September 15th. and a small quantity of oats will benefit the horses considerably, especially those intended for winter work which should be saved as much as possible.

Those of the pack horses which will not be retained for Winter work with sleighs should be sent out in the latter part of October or early in November, the exact date depending on the kind of season, and the distance they must travel to get out. It is advisable to have them move a cache ahead, before they leave, if there is not one placed ahead already.

Through the early part of Winter the tamarac grass with the addition of oats will keep horses in good condition if the snow is not deep.

The question of having a tent for team horses in Winter is a very debateable one. If there is a constant supply of hay available so that the horses will always be tied up, and if moves are not too frequent, a tent is unquestionably an advantage. When, however, the horses have to rustle for themselves part of the time, as is nearly always the case on base lines, the change from the steaming warm air of the tent to very low temperature outside would have a serious effect. Apart from this the chief objections to a tent are the way the moisture keeps it frozen and it would probably be destroyed in a short time by the frequent handling when putting it up and by the restlessness of the horses.

A dog train is always a valuable auxiliary to have in camp in Winter. As freight carriers dogs are not efficient, but they have three valuable advantages in the comparative ease with which they can be fed, their speed and the small amount of work required to make a trail for them. They are not recommended for main transport in a thickly timbered country, but are valuable for auxiliary work such as supplying a shortage from a distant cache or trading post, getting and sending mail and for moving a flying camp. A dog must consume a large proportion of his own load. One hundred pounds per dog is a high average load, and of this he will eat four pounds a day of fish or meat. The use of dogs requires extra work in caching meat for them .

One of the miscellaneous articles which should always be carried is a liberal supply of hay wire, many contrivances and repairs would be impossible without it.

A matter as vexing to the surveyor as to the Department, is the question of mail. The Indians who stay around the posts are, as a rule, lazy and unreliable and it is often impossible for the postmaster to get anyone to bring the mail to camp. The alternative is for the surveyor to go himself or to send some member of the party. Throughout most of the north the mail service is monthly. The only suggestion which can be made is to attach an additional man to the party in the capacity of assistant explorer, such a man would be useful in many other ways. In this connection it may be said that the efficiency of the whole party would be increased by the addition of two such men over the total of 21 now allowed.

Much could be said on the subject of the relative advantages of Summer and Winter work. It is advisable not to draw too hasty conclusions. Arguments excellently supported by the experience of one Winter, or one section of country, might not apply elsewhere. For a muskeg country in general the conditions in Spring average the best, that is from about March 15th to June 15th. From June 15th to Oct. 15th, the chief difficulties are making trails over muskegs, the flies, excessive rainfall and heat waves interfering with instrumental work. The advantages which this period of the year offers are good mounding conditions, long days, and good horse feed. In the period preceding March 15th mounding is difficult, the snow more or less retards progress and horse feed must be provided. On the other hand during this time trail work is generally easy and the working conditions for the men are good. Probably the varying conditions can be used to best advantage by golng out to the work in the late Winter, after the worst of the cold weather is over, and the days have commenced to lengthen, but while the ice on the lakes and rivers is still good. If this is done a base line will be completed in the ordinary course of events, about the end of Summer.

So far as instrumental work is concerned, accuracy should be independent of the season, though the ease with which it is obtained will vary slightly. In Summer the obstacles to good work are the heat waves, bad ground for transit and level stations, and cloudy weather makes it often difficult to get observations. The troubles in Winter are due to the cold, to snow and often to a kind of mirage over snow.

The Chairman: You have heard a very thoughtful paper. Along the same lines I believe we have a paper from Mr. J. N. Wallace, and before any discussion is started on Mr. Blanchet's paper, perhaps we had better hear Mr. Wallace's paper.

Secretary Hubbell: Before reading Mr. Wallace's criticism, we have a little time.—Mr. Blanchet's paper did not take as long as anticipated, and we might have a few minutes for discussion. If there are any questions members present desire to have further knowledge on, they should ask Mr. Blanchet to give them the information now. His paper, in connection with Mr. Herriot's and others on the same subject, are of great importance to every surveyor, more especially to those employed on base lines, as transportation is a large factor in connection with surveying. There are a few questions we might consider.

I understand base line men have 31 horses in a party, and that they carry in bulk about 4,000 pounds or a camp equipment of 5,000. In reference to the feed for horses, I presume when necessary to have hay or fodder they use baled hay?

Mr. Blanchet: If it is possible to get it up ahead.

Secretary Hubbell: In general you use baled hay?

Mr. Blanchet: Yes.

Secretary Hubbell: That is put up in bales and the horses would require about one-third of a ton every twenty-four hours—that is twenty pounds per horse.

Mr. Blanchet: When feeding hay you only have your six or seven winter horses—we do not feed the whole pack train.

Secretary Hubbell: What about oats?

Mr. Blanchet: In winter eight pounds a horse, and in fall or spring four or five pounds.

Secretary Hubbell: Another question, you spoke about the cache being subject to attack from large animals such as bears, and small ones such as mice, etc.—do you always put the floor on the ground?

Mr. Blanchet: Yes.

Secretary Hubbell: Did you ever see floors raised from the ground?

Mr. Blanchet: Yes, Mr. Wallace raised the floor to keep mice out but it didn't work.

Secretary Hubbell: It struck me that a floor raised on poles, tied with baled wire, four or five feet apart and about six feet high, would keep the mice away.

Secretary Hubbell: I have received from Mr. J. N Wallace, D.L.S., Calgary, a paper containing remarks on Mr. Blanchet's paper on Transportation, Mr. Wallace has requested me to have his paper read after the reading of Mr. Blanchet's paper, at the meeting—which I now propose to do.

SOME REMARKS ON MR. BLANCHET'S PAPER ON "TRANSPORTATION."

J. N. Wallace, D.L.S.

The paper is the most able treatment of this difficult subject which has yet been put in writing. It does not intend to cover the whole field, but deals only with those districts where horses can be used both in summer and winter. Mr. Blanchet's opinions are especially valuable, as they are those of a surveyor who has had much experience, who is endowed with a disposition which is always on the watch to profit by experience, and who has, in a marked degree, two qualities, which, I think, are very necessary for success on Base Lines;—personal energy and devotion to one's work. His opinions are unbiased by considerations of personal ease. There is no advice to leave "with the first grass" or "by the first boat," if an earlier start can bring better results, even at a greater cost of trouble to the surveyor.

In regard to Mr. Blanchet's strong opposition to having the pack train separated into two parts, it must be remembered that it is not always possible to avoid this. While admitting that, with caches previously placed along the course of a line, there are very great advantages in carrying all the supplies with the camp, yet cases occur where the surveyor would be quite unable to follow both of the two rules which Mr. Blanchet lays down, namely, that the total load carried with the camp shall not be greater than can be handled by two trips of the horses, and that there shall be no separate supply train.

When moving camp along a survey line, the first consideration is to have it moved as speedily as the men are cutting out the line. Mr. Blanchet considers two trips as the most which can be made without delaying the camp. I do not see how he can carry three months' supplies at the start with only two trips, nor does it seem necessary to cut down a cache to a two trip load, in any event. Even in the case of trails being so bad that horses cannot make the round trip back to the last camp in one day, but require a day to go each way; even then, three trips should be feasible for the first few moves. Three trips mean five days' travelling, and by moving camp three miles ahead of the line each time, moves can be spaced far enough apart in time, to allow the horses these days. But in many cases, even three trips cannot carry the whole load. Mr. Blanchet states that the first trip can only carry the camp outfit, beds, dunnage, etc., and a few days, supplies. His whole three months cache must then be moved on the second trip. He allows fifty hundred for the whole train load. This seems to me a very high estimate for thirty horses on a survey trail. I would put it at 4,300 pounds, allowing for weak horses and bad trails. Nor do I quite see how three months' supplies for 21 men can total so little as fifty hundred. I should estimate it to be nearer seventy hundred. Each man will consume three pounds net supplies per day, which amounts to 5,700 pounds, and at least 20% should be added to this for weight of packages, or 6,800 pounds in all. Canned goods, especially butter and milk, weigh much more than their net weight and, in addition, there are such things as even a small supply of oats, iron posts, etc. Three trips should, however, be practicable. But when caches cannot be previously placed at three month intervals, such as when surveying a Meridian, or when reliance must be placed on bringing supplies up to the location of a line in summer from some outside point, a division of the pack train into two is the only solution possible.

Mr. Blanchet's contention that all should be hauled with the camp has unquestionably great support in practice, but he is not quite right in the statement that a cache represents so many horse loads, and that therefore the work is the same, no matter how it s handled. Theoretically, the soundest method is to divide the pack train, because every pound of supplies laid down in camp ahead of the time it is needed represents lost efficiency, inasmuch as a smaller transport outfit could have done the same work by using up the full amount of time available before that pound was needed.

By carrying all at once, it is obvious that many of the horse-days are unoccupied at the end of each cache division. Work has been done all through the division ahead of time, and possibly at the cost of other work, such as moving camp, more pressing at the time. Theories are, no doubt, false guides, if too rigidly followed; but, on the other hand, a practice theoretically unsound should always be tempered in the direction which theory points. It is not denied that in this case the practical benefits of carrying all at once are overwhelmingly in the majority but, none the less, surveyors should recollect that the practical benefits of not dividing the horses are gained at a well defined cost, and that cases may occur where this cost may become so pronounced that the balance is the other way. Take, for eaxmple, very light timber, requiring frequent camp moves at the start,. and very heavy timber on very bad trails, requiring slow moves in the latter part of a division. In such a case the pack train should, undoubtedly. be divided into two. The camp train moves rapidly forward at first and, as the last miles of the heavy timber are cut, the supply train has caught up and is delivering the last loads in camp at the end of the division.

It is, however, seldom practicable to place caches, before the survey of the line is commenced, at definite distance apart. but every effort should be made to cut the intervals down, and I would even favour aiming at 50 mile intervals.

It often occurs that the starting point of a survey is the farthest point to reach at the commencement of a season. In such event a good general rule is to place a cache on the line about twn miles from the starting point, and to place two other caches, dividing the balance of the line into three parts, the last part being the shortest, to allow for supplies for the trip home On going out to work, the trail to the first cache can be used to get to the location of the line, and then a small road can be cut to the starting point. Another small rule is always to have the first camp right at the starting point, if at all possible. The first few miles are always dangerous with an untrained party. Errors in chaining or in levelling made here have a worse effect than if made anywhere else, and, with a camp some miles away, haste is sure to occur in these first miles, with the almost inevitable result of error.

Mr. Blanchet's remarks on the division of the year into periods are especially valuable. As time goes on and Base Lines get further north, the question of feeding the horses gets more and more prominent. It is not too much to say that even at the present time (excepting in some parts of Peace River District), horses should really be fed more or less oats at all seasons, except from June 15th to August 30th, or for nine and a half months out of the twelve. In this matter of horse feed, it is somewhat remarkable that every packer strongly recommends crushed oats, yet no surveyor seems to have used them. There is no doubt whatever that survey horses do not get the full nutriment of the oats they eat. They are so hungry that a large percentage is never masticated at all.

The advantages of a horse tent are, I think, greater than Mr. Blanchet allows. It is quite true that a pack horse, accustomed to wander all summer, appears to prefer his liberty out in a cold night rather than standing in a warm tent; yet here again, practice should be tempered by theory. The loss of animal heat must be enormous when the difference of temperature of horse and air is some 140°, and this loss of heat can only mean the waste of so much feed, hauled, perhaps, hundreds of miles. The labour of putting up a tent is not much greater than that of protecting the hay supply from loose horses. I do not think the small quantity of nourishment a loose horse picks up at night, unless a very good slough is close at hand, can balance the loss of heat. One thing is certain, a horse should not be in a tent some nights and outside some nights. I think a good medium would be to use a tent continuously through January and February. No harm will result by suddenly putting a horse in a tent, and then, as soon as the cold gets less intense, the horses could be left outside, but my own experience is that it always ends by tying up the horses, whether a tent is used or not.

Where no tent is used, two extra pack blankets should be sewn right on under the usual city horse blanket, so as to make a three-ply solid cover which cannot come apart, and the means of fastening it to the horse should be much more elaborate than usual. Ordinary canvas pack covers, with pack blankets sewn under them, make a good protection if no regular blanket cover is available.

As to the value of cutting out a really good trail, no general rule can be laid down. A good sleigh road pays, and I have no patience with men who do not cut a pack trail out wide, but it is often impossible to make a good pack trail in swampy country, unless by going miles off the line, so that a six mile camp move might run up to fifteen miles. When horses only walk two miles an hour on the best of trails, and every extra mile means added difficulty in getting the axemen to work on the trail, and is subsequently multiplied by at least three for the extra trips of the horses, it should not be too lightly assumed that time spent on making a first-class trail pays.

In regard to the relative advantages of summer and winter work, Mr. Blanchet's advice not to draw any general conclusion is eminently sound. It is a common thing for surveyors who have not had experience on Base Lines to say they would do all such work in the winter. They do not realize the enormous difficulties of securing hay and transporting it along a survey trail, and they do not realize the shortness of the winter season. A party organized purely for winter work cannot leave for the field till December 15th, often not even so early, if dependent on a frozen river for a route, and it must be back by about March 15th. This is only three months in all, probably only two nomths on the actual line. A party out in the field in summer and working continuously on into winter, and then able to get home independently of the ice, can put in from November 20th to April 1st, but it means ability to change from pack horses to sleighs and back again while still in the field, a matter which is only possible if sleighs can be made available when wanted. Mr. Blanchet's conclusion that the best general method is to start out towards the end of winter, and so get the outfit on the ground by sleighs, and then to do the bulk of the work in summer, is the best general answer that can be made. Winter work is good when you cannot work in summer. A general conclusion to always work in winter instead of in summer is founded on want of experience of the surroundings of Base Line Surveys.

Mr. Blanchet's remarks on dogs must be construed as only referring to districts where horses can be used. The use of dogs in preference to horses is subject to the same rule as using winter instead of summer:—Good, when you cannot use anything else. His estimate of a dog's feed weighing four pounds a day seems high. Mr. R. W. Cautley states that a dog's ration in the Yukon is one pound of bacon and one pound of rice, and that dogs do well on this. Rolled oats and grease is another good food, but more liable to be burnt when cooking than rice. In the Yukon a dog team is composed of seven dogs. The load is carried on a light sleigh with runners. The dogs do not run, but walk. A fair load for the team is one thousand pounds. Mr. Cautley has made a suggestion that the importation of big huskies from the Yukon to Northern Manitoba might solve the transportation problem there. It is worthy of being looked into.

The Chairman: Gentlemen, you have heard two very excellent papers here this morning. Is there any discussion? on them? We would like to hear Mr. Hawkins.

Mr. Hawkins: Mr. Chairman and gentlemen, I have listened to these papers with a great deal of interest. Mr. Blanchet makes some very interesting and pertinent remarks with regard to transportation on base lines. I would just like to refer to the division of the pack trains. As far as my experience has gone, I could not do it unless I tied the horses up that were taken from the main pack train, and it requires serious consideration, I think, to divide your pack train into two and send them twenty miles away—you would find them back in the camp next morning—they would not stay tied. That would be a serious obstacle to dividing a pack train . My name is down for a paper on "Pack Trains," but it should be on "Chaining."

Secretary Hubbell: Then you can read your paper on pack trains also.

Mr. Hawkins: Yes, any time it suits.

The Chairman: Perhaps Dr. Deville would like to make a few remarks.

Dr. Deville: I have listened with attention to the reading of these papers—they are very interesting and the subject is an important one. The great difficulty now in the survey of base lines is transportation. I cannot say much about it personally; when I was surveying we had not these difficulties to contend with although we had other difficulties, so I came here rather to listen than to offer advice. A surveyor has to deal with that question with judgment. If a surveyor finds that with a pack train of 31 horses, he cannot carry his supplies, he may be inclined to say, "31 horses are not enough; give me more." I think surveyors with experience will agree that getting more horses is not a solution; how to feed them is the question. It is the same with dogs. In winter, a surveyor may think he can carry all the supplies he wants if he gets enough dogs—that is not my view. Dogs may do well enough for light traffic from one camp to another, but for regular transportation, they are not suited. I do not propose to offer advice, but from what I can see and what I can gather, each survey has got to be considered by itself, and the means of transportation considered in order to decide what is to be done. One of the great difficulties now is with caches. Formerly we did not have much trouble with caches, they could be left alone for a long time and no one interfered, but during the last few years surveyors on arriving at a cache have frequently found the supplies gone, and that is an extremely serious matter. I would like to have suggestions as to what can be done in this connection. It seems to me that there ought to be some means of finding out who are the guilty people. There are not many people in these districts apart from the Indians—and it is not done by the Indians. These people must be known, and there ought to be some means of finding the guilty ones. The base line surveyors should endeavour to trace them.

I wish to express again the interest with which I have listened to the papers, and to state that they have given us some valuable information on the subjects dealt with. (Applause).

THE CHAIRMAN: We will proceed now to the next paper, but in the meantime I think Mr. Blanchet and Mr. Wallace are entitled to a vote of thanks for these able papers, and I think they should be copied in the proceedings.—(Applause).

On motion of Mr. Fontaine, seconded by Mr. Currie, a vote of thanks was passed to the two gentlemen in question.

MR. W. M. TOBEY, D. T. S., then submitted a very valuable paper on "Geodetic Results and their Practical Meaning."

MR. TOBEY: It has given me a great deal of pleasure to listen to these papers that have been submitted. It has occurred to me that there is no similiarity between the subject and mine.

GEODETIC RESULTS AND THEIR PRACTICAL MEANING.

MR. CHAIRMAN AND GENTLEMEN.

Before beginning directly my paper, "Geodetic Results and their Practical Meaning," I desire to give a few preliminary remarks leading up, so to speak, to the direct handling of the subject.

No person recognizes better than you practical men the need and demand of Accurately Graduated devices, and yet their limit of Use. Take your ordinary graduated scale. Small as it is, it must be most accurately divided. Costly dividing machines and much skilled help, demanding hours of labour, are necessary to produce such Graduated Scale, as only such firms as Keuffler and Essler too well known. How can you plot distances truly, you say, if your Scale is the least wrong. And so, to meet your demand, skilled firms are continually busy in constructing such accurate (so far as they know) graduated scales.

But accurate as your graduated scale (say, 1 foot long) is, how small, how very small, is the *size* of the paper you apply it to. At best only to some maps 6′ x 5′ large. No person, you say, would be so bold as to apply a foot scale (no matter how accurately it is graduated) to distances so large as 500 ft. or even a mile. It is too small compared with the area to be controlled or measured. The accumulative errors, due to overlapping ends, to the difficulty of keeping your course straight, to say nothing of the tediousness of the time demanded, would prove too much. Thus your foot, the most accurately graduated scale is limited in its use, and has failed you for larger needs. It is *limited*, as fig. I shews, how limited in use, or which is the same, how large the uncontrolled region is.

Thus it is, you are equipped with a larger and most accurately divided chain. The necessities of your work to be controlled demanded a scale of this size. Need I say that no less care is exercised in its preparation.

Yet accurate as your standard may be, who does not realize that the repeated application of it is bound to bring about errors greater than the graduations of your used chain. Who of you does not feel the need of a *Control* for your work, does not feel that your chain is *limited in its use*. Every one of you who does such work, tries to make his own control, perhaps a base or a known point to check on. How happy you are when such a control is provided to you.

But what of the many measurements that are being made that have no control and that fall in the uncontrolled region. Many such have been made. Some have been controlled in subsequent years and found to be vastly in error. Others stand as they were made, still longing for that control which only will give them reliance.

Gentlemen, I here present to you a larger Graduated Scale.

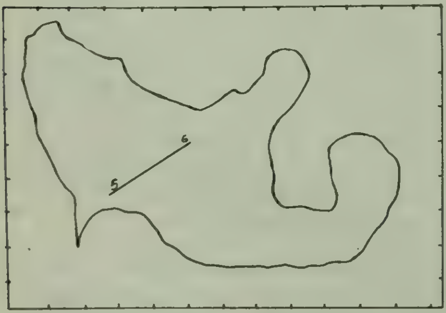


fig III

Uncontrolled.

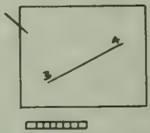


fig II

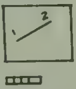


fig I

A scale, which, while not graduated by Dividing Engines as in Fig. 1 and as in Fig. 2, is graduated in an entirely different way (of which way I hope to say more later) and which will have accurate graduation for thousands of miles East and West and for thousands of miles North and South. How mighty it is, you will easily see by comparison of it with the chain scale and the ordinary foot scale (which I have had to draw larger than they should be.) It has overgrown the Uncontrolled region, has covered up all such. Our scale, in place of being small compared with the Control Region and the Uncontrolled Region, has expanded to cover all. It becomes the centre of our attention. In the small figure only distances like 1-2 can be obtained by repeated application of the Graduated Rule. Similarly in Fig. 2 only distances like 3-4 can be obtained by repeated application of the Graduated Rule. But in Fig. 3, distances like 5-6 read off at once, no repeated application of the rule. All distances will thus be read off directly, and no region will be left out, *i.e.*, there will be no Uncontrolled region as in Fig. 2. And I call it a *Scale* because it is to carry accurate graduation as other scales. And its object will be to abolish all the Uncontrolled region, *i.e.* not to be limited in its use. Such large scales exist in England to-day, for the whole of England is one graduated scale, a scale of which I may speak more hereafter.

Gentleman, may I for a few moments in a non-mathematical manner, try to shew you how this large Scale is graduated, so that it will be a control for measurement at *all* points. It is not graduated as other scales are by Dividing Engines, but by an entirely different process.

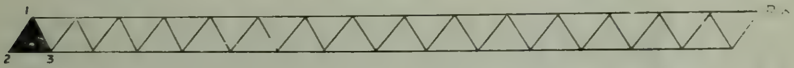


fig IV

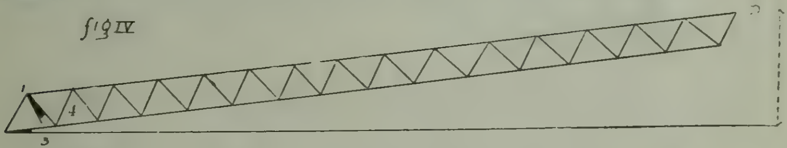


fig V

In making a scale we had to start at some beginning. *e. g.*, a measured line 12, whose end positions are known. Suppose a chain of equilateral triangles were extended therefrom, and suppose we took the surveyor's word that all these triangles were accurately measured and all exactly to 180 + ϵ. Approximately plotted they would extend in a row so. But suppose we found out, that is, the office graduators found out that the field man measured the angle 1 about as much too small as he measured the angle 2 too large. Such an error the field man cannot *possible* find out, you will at once grant, for to him the sum of his 3 angles still equals $180 + \epsilon$. He thinks his measurements are still O. K. But *granting* we have found this error, so that the part 3 should be at 4, why should *so much stress* be laid upon it, you say.

To answer this, I will suppose the remaining triangles all accurately measured and plotted now on line 14 instead of 13. You can easily see how much the point D_t differs from the Point D in vertical height. Though 4 was only a very short distance from 3, yet the effect on D was much greater, as you can easily see. In fact many, many times greater.

Thus it is that a little evil at 4, soon grows to a great crime at D_t. We cannot be too careful to make a right beginning in Graduated Scale Life. If our scale is to be a scale which will give accurate information and be a control at the point D as much as at the point 3, we must always remember that all errors have a tendency to grow, and we must try to exterminate the evil in time, so as to be fair to the person at D_t who may need help to control his work.

Thus it is that the Graduator exercises care and worry over "beginnings," *e. g.*, at 4, which are often most unintelligible to the field man and which by him are considered almost useless. Ever must the Graduator remember the wants of the distant person D, and that D demands as great an accuracy of his position as 1, the initial.

Before I go further with concrete cases, to shew how the Graduator makes it his *Cardinal Aim* to exercise the greatest care in the beginning of his work, it is well to see what the graduator has to begin his work with.

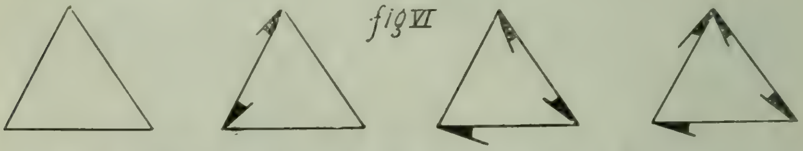


fig VI

The ordinary triangle you see, while thought to be perfectly well observed, may have many so-called fluke cases. And in fact every part of the figure IV may be in doubt without the field man having the least idea it is so. Thus I leave it to you to determine what are the *chances* that the distant man D may have even a *tolerably* sound position. His position must be very much in doubt and cannot possibly be a control for others at D, (which is the basis of all our work).

Great as the doubt to D's position, is and impossible as it is for the field man to know its position when he uses a simple chain of triangles, you can easily see it is still more complicated when a chain of quadrilateral is used.

In the case of a chain of triangles, this distortion was due to a small uncontrolled error in the line 13. This line 13 is wrong because the *distribution* of errors 1|3 to an angle was far *too ideal.* No person would say that exactly 1|3 of the error was made at each angle. It is most improbable that such is the case and when we so treat a triangle distortion sets in. Also a central point figure of any number of sides gives an ideal solution as one tendency of the errors is to be + and – as shown in Fig. VII, and which you will grant is not right. Similarly a quadrilateral gives distortion on the line ¾; the distribution of errors, though better than for a single triangle, is also too ideal.

A quadrilateral is better than a triangle because the angles A and B are checks to the positions of the points 3 and 4, yet it is far too ideal a solution, and when a chain of quadrilaterals is set up as in Fig. IX any wrong adjustment of the direction 3, 4 will tend to be magnified and to distort D.

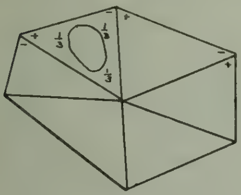


fig VII

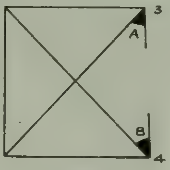


fig VIII

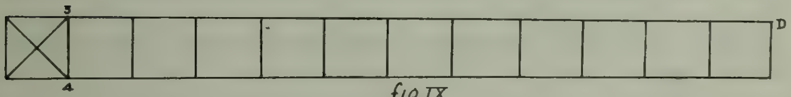


fig IX

Gentlemen, I lay it down as a *principle* that the adjustment of small figures as of a triangle or a quadrilateral, is always dangerous, and must always tend to produce distortion, which is the great enemy of all Graduators.

In general the field man does not work through a single figure, but through a complex figure where all triangles, even if apparently

fig X
for
Conditional Adj

Prelim.
for
Co-ordirate Adj

exactly measured, most probably have Insidious errors as shewn by Fig. 6, errors which the field man cannot possibly discover, however conscientious he may be.

The question then naturally arises, is it possible for anyone to locate such errors, is it possible to reconcile the many paths amongst a complex figure, so that not only will they all place D at the same place but will place D truly or very truly where it ought to be.

Gentlemen, it remained for Dr. King to see that, if accurate Graduations are to be given for the country, one could not depend upon the field results entirely; one must not allow such insidious errors as shown in Fig. 6 to go through; that one must also correct the numerous other evident errors made in the field; that out of the entangled whole composed of many paths leading to a desired point, all giving different values of that point D, one must establish a most reliable or most probable way, which will give to D. a feeling of reliance for a control to his work. It remained for Dr. King to see that such could only be done by considering the Mathematical Theory of Errors, errors as man really makes them, which theory has been worked out years ago by the ever famous Mathematician Gauss.

To Gauss as to others, all Geodetic Survey work ends by a succession of clashes and discrepancies, utterly unable to give one definite information re D unless treated mathematically. I unhesitatingly say that, without the great labours of Gauss, all Geodetic Surveys would most probably end with such clashes and discords, and, what is worse, most violent distortion, unless treated mathematically along the lines laid down by Gauss, and which, as I said before, has been only too well recognized by Dr. King.

No other treatment so far known gives such good results, frees from distortion as the Mathematical treatment as devised by Gauss in his Least Squares and Höhere Geodasie.

You will naturally ask how can Gauss's treatment cure such ailments as shewn in Fig. 6. It cannot, gentlemen, if only one triangle is directly affected by the error in 13, *i. e.*, if only one triangle is pointing to 13 as the cause of the trouble. But if *many triangles* are pointing to 13 and *complaining* of 13 as the cause of their trouble, then by Gauss's procedure we can feel it is time to correct this troublesome 13. I say again we can do it if the figure is a net as in Fig. 10, and that we have done it successfully, I only state that numerous field errors are always to be found and have been found in all field work. It is then part of the duty of the Graduators to advise the field where such lines as 13 exist, lines that different parts of the triangles are loudly complaining against, as Mathematical analysis shews.

You will again say, what is the chance that your diagnosis of the trouble in 13 is really true. While we cannot give the exact error, yet we can generally come very close to it, *i.e.*, the probabilities of locating it by Mathematical treatment of the errors are good. The "probabilities," a word I have just quoted, will undoubtedly call up weather prognostications. Even these, you will grant, are correct in the majority of cases. But when you consider probabilities as treated Mathematically, your chances of being right are much greater. May I for a few moments draw your attention to the exactly similar subject of Life Insurance. As you know it is all treated Mathematically and based on Probability. No person gain-says the wonderful general accuracy of the tables telling one's chances of living so long. In fact, so reliable are they that Millions of dollars are directly involved in them and absolute reliance is felt on the "Probability Results."

Now the Mathematical treatment of Probability by the Insurance men is exactly similar to the Mathematical treatment of the probable location of errors in our work (as well as of the Probable Errors in ϕ and λ, etc., of which I shall speak later). May I say here that I believe such treatment as desired by Gauss will, in the great majority of cases, locate all such insidious errors as shown in Fig. 6.

Had large nets not been considered, I feel quite sure we would see the *Shadow* of Distortion gradually rising (near Muskoka, Anson, etc.) and projecting itself below Liniere and Standon, as I have tried to show by the shaded region. Such a shadow would have arisen if the adjustment *near* the line Royal-Bellevue had been by *small* figures *only* just as in Fig. IV where an adjustment of small figures takes place and where you know weakness exists in the beginning and is magnified towards D.

Gentlemen, the Office Graduators of this work continually work under the "Shadow of Distortion." It is ever an enemy, a lurking enemy which it is our fate to combat against. And to keep this Shadow from creeping up here and there, is, I know you will grant, what we should take every known means to prevent. And one of the best and most helpful agents is the Adjustment by *large figures.*

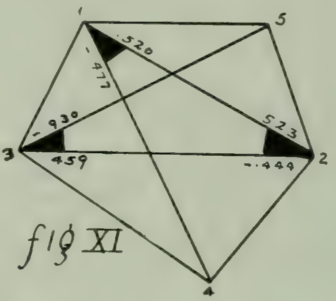


fig XI

Thus in this figure, which is a part of Fig. X, all the triangles when given "closed" to within 1,"1 a very small quantity. As every triangle has six (6) directions, the errors to the directions ought to be very small. Now adjusting this figure not just to itself, but with all the whole figure X (as shown on P.) it resulted that insidious errors had been made. The directions 12......etc., were the guilty ones, giving v s (See Fig. X. And may I say that these errors could never have been found if the adjustment had not been of a *large net.*

Similarly Insidious errors were found in the directions King-Elmsley and King-Buckingham, and the field were advised to repeat these observations. Consequently in 1911 re-measurements over the 1909 measurements were made, the differences of which are shewn thus.

Directions.	1911-1909 values.
King-Elmsley	2".01
King-Buckingham	3.09

And again I say such could only be found by the adjustment of large nets, *not* by small adjustments, the worst of which is the adjustment of a triangle as shewn by Fig. IV.

Remembering that the field made estimations to .″1, you cannot but wonder how errors of 2″ to 3″, *i.e.*, 20 to 30 times the smallest estimation .″1, can be made.

Without going into details I will simply say that these are nearly always due to external influences, peculiar varying conditions of atmosphere, etc., which have a tendency to maltreat all the field man's readings many, many times.

As such varying atmospheric conditions are nearly always in vogue, and as their effect is to produce Insidious Errors in all the field work many times .″1 (the smallest field estimate), you will see at once that a field instrument fails in its duty now and then, that though it is most finely graduated it cannot correct Insidious errors, and in fact that until the great external varying causes can be determined, there is a limit to the graduations of field instruments. For example, what could it possibly serve to have estimations to ″.001 and not be able to control the varying external influences which often have effects of 2″ and 3″ of arc?

As these external influences are bound up with the subject of weather, varying densities of the atmosphere, radiation of heat from different surfaces, the influences of general uneven surfaces of the earth, etc., it is hardly likely that such will ever be accurately known. They will always be lurking foes, the effects of which (by giving rise to Insidious errors and other peculiar errors) can only be located by the office graduators.

The nets, being in the most settled part of Canada, are very important. By them was determined the position of *Scotch Bonnet* and Presqu'isle to A, which were needed by the International Waterways Commission to determine the end values of their *Chords* stretching across the lake. These I may say were the 1st values given out by us. Also for the Hydrographic Survey the Graduations of Gibralter Lighthouse were given, so as to control the small green triangulation along the shore of Lake Ontario, which triangulation had its start at our Graduation of Presqu'isle Lighthouse. As a control for other Surveys, I may say that all the Province of Quebec values have served as accurate graduations for the Militia Department, to control their many small surveys, as an example of which I have indicated the Militia Department's work in green near our Graduation "Ham," which green triangulation was uncontrolled till it received the aid of Ham's graduation.

The Hydrographic Survey of the St. Lawrence, as executed by Mr. Stewart, which Survey I have attempted to shew in green on the Map, was also controlled by Graduations in the neighbourhood of his work. Similarly the Geological Survey requested our graduations on the Gatineau work, as also the Chief Geographer of the Interior Department (Mr. Chalifour), for his maps of Canada in general.

The general purpose of all these graduations is therefore not only to give such control to these aforesaid departments (Militia, Hydrographic and Geographers, etc.), but to be able to offer a helping hand to distant persons D. Two most important distant persons *D exist*, one in the direction of N. W. Ontario along to Lake Superior, the other one near Detroit. In the N. W. direction we hope to clasp hands with the Graduations around Lake Superior as shewn by

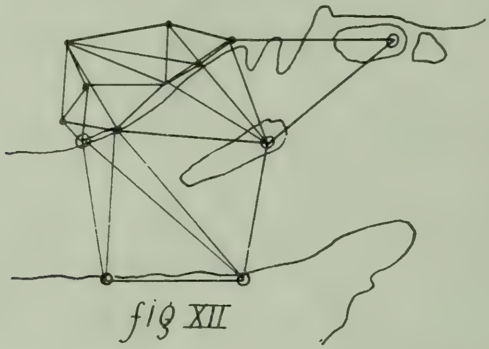


fig XII

and so give accurate graduation, accurate control to all the distant persons D, D_1, D_2, lying between Georgian Bay and Lake Superior. And because we want to be fair, by such fellows as D_1, D_2, etc., is, as you have seen from Fig. VI, our reason for exercising all care possible at the beginning of our Graduation as shewn around St. Lawrence.

The other great aim is to join hands with N. A. Datum values of Walpole and Deerbrooke. Thus another line of distant persons, D_1, D_2, will be served.

By their working out, all lines meet point to point, as shown by the Black lines. That all the field man's observations on Yamaska, for example, from the 8 stations, pointed directly on Yamaska, you will agree was almost impossible. In fact, if you would each be placed in possession of a Microscope to *examine this point Yamaska*, so as to see how the observed lines fail to hit Yamaska, but lie all around it, you would see that the directions would lie about as I have shewn by the red colour. Now any two intersections of lines could have fixed the position of Yamaska.

It might have been here, there, a fact in a great many places. And you can easily see that if any one of these had been chosen, how great would have been the consequent distortion in our Graduations. The position of Yamaska, as shewn by the black point, was only secured by considering the net as a whole, by allowing all the influences possible to work for the location of such position. Similarly you see how the observed lines on Oro, Monmouth and Anson lie in respect to the *final lines*. (See Fig. X.)

However conscientious the field man may be, as I said before, his work can only end in clashes, as depicted by the red areas around a few of the points I have drawn. To make our Canada the fair country we hear so much of, to remove these distortions from her face, to give her that point to point Net work, as she deserves, is what the Graduators ought to do, when field results are submitted to them.

That adjustments should only be done by large nets, is the belief and working principle of the U.S. office by Mr. Bowie, Professor Hayford and Dr. Helmert of Europe. Time and time again in these places, the field is advised to look here and there for certain errors and almost invariably are such found, and it is to be noted that most errors are always found after field work is completed. And this can only be done when the figure is a *net*, as in Fig. X, not a single chain of triangles as in Fig. IV; otherwise the insidious errors would go through and allow to work full damage at D.

I have tried to show you so far the *necessity of large nets*, the danger of small chains, and the necessity of having a Mathematical treatment of large nets to advise the field re the location of errors, and finally to build up a Graduation at D which would be reliable and trustworthy.

So far, as I have said before, a number of large nets have been worked out in Ontario and Quebec, see Fig. X (our starting point being Vankleek Hill), spreading from Quebec to Grimsby. But, however consistent these nets may be amongst their values, however devoid of clashes, so that all parts of triangle chains lead to the same D, it still has one serious error. If Vankleek Hill is *not* just where it is, then everything is deranged. Thus in Fig. X. And you can easily see that all points of our triangulation are out by nearly the same amount and hences the Graduations are not, in this repsect, reliable to distant persons D.

This is the very hardest thing to get rid of. Our erroneous position V_2 is not so much due to the errors of observation in

ϕ and λ at V as to the fact that the Vertical at V is tipped to one side. I will not go into this question which you recognize as that of Deviation of Plumb Bob, but simply to say that the Deviation of Plumb Bob is a fact and of large values being anything from 0″ to 30″ in ϕ and λ, and of course has different values at different places. Thus all Astronomic values of ϕ and λ and α are all full of these huge errors of the Deviation of Vertical.

The difference between a triangulation errors and Astronomic values are thus:—

As the triangulation spreads, it carries to every point the error of Initial Station error, as I have already said. But the Astronomic errors at different points are not all the same. They are of all sizes and signs.

Generally for many years the Graduator has to be content with giving graduations that are consistent amongst themselves, just as a graduated ruler may be, graduations which are all in error by an almost consistent amount, *e.g.*, if the ruler were pushed to one side.

For many years the U.S. official Graduators had this difficulty, and in fact they had many such difficulties, for they had a number of scattered triangulations over the country, each containing a large station error. You can well imagine how such would clash as time goes on, and how unreliable, to say nothing of confusing to D such values are.

But, as time went, many Astronomic values were also put down and the clash with these noted, the result being that a Mathematical treatment of these clashes was possible, so that all their triangulation, in place of being scattered and depending upon erroneous different points, was made to depend upon one point, whose position is *most probably* very near the true Normal. Gentlemen, I say "most probably," and you will notice again that I am bringing in the wonderful science of *Probability*. From analysis of their results I believe the probabliity is reliable, *e.g.*, that the ϕ of Meades' Ranch is really very near what it ought to be. Thus all points of their triangulation carry *most probably* a very small station error. And, gentlemen, I want to say that it took them years, by examining the clashes with many Astronomic values, to arrive at this conclusion. I firmly believe it would take us at least 50 years to reduce, by many Astronomic comparisons, the Station Error at V. Consequently, Dr. King has thought it well to adopt the values of certain points from the U.S. triangulation (which carries the small station error of Meade's Ranch), and so build up our Graduations on it. Our *triangulation* thus in place of carrying through the *large station error* of Vankleek Hill and continuing to do so for perhaps 50 to 100 years, *starts off* at once by carrying only a most probably small Station error of Meades Ranch. I have gone into this matter in quite detail, for I think it is a matter that the public should thoroughly understand; that we are not checking on American points, but that we are building up on their results as we believe the Station error at Meades Ranch is smaller than that at Vankleek Hill.

I may say that our original Graduations, as given to the Militia, Naval snd Geographer's Departments, were dependent upon Vankleek Hill, *i.e.*, were on the Canadian Datum. I hope soon to have all our points referred to Meades Ranch, *i.e.*, on the N. A. Datum, and I believe such Graduations ought to be far more reliable to all distant persons D who may need them as control.

I have here a small *table* to shew you of some of the differences in values of the Co-ordinates of points on the N. A. Datum and those on the Canadian Datum.

N. A. DATUM—CANADIAN DATUM.

Station.	In ϕ.	In λ.	In α.
Standon	$-2''.656$	$+''.215$	$-3''.735$
St. Armand	-2.784	$-.005$	-3.495
Oro	-3.070	$-.307$	-3.034

You will notice the differences in ϕ are not constant, neither are those in λ constant. Our American points were Royal and Bellevue. You see there what the differences are between N. A. Values and Vankleek Hill values. As we go N they increase positively in both ϕ and λ. This is as one should expect. If our reference body were a plane and all meridians parallel lines, then if the triangulation were given different values at Royal and Bellevue, all the other points would have the same differences. But as the earth's meridians are convergent and the reference body is bent on an ellipsoid, the values will not be the same.

This difference between N. A. Datum and Canadian Datum, will be slightly changed, for the N. A. values are built up only on the line Royal-Bellevue. In future they will be built up not only on this line but on our Canadian Bases, which are two in number.

So far, gentlemen, my paper has been mainly introductory and historical of what I know you wish to know, re the detail of our adjustments, and shall I say of some of our care exercised in building up our Graduations so that distortion at D shall most probably be wiped out. Even though the triangulation has all been Mathematically adjusted by Gauss procedure, so that all paths lead to the same result at D, we must remember that the whole is really a framework, a jointed framework, which is not, as I said before, laid down on a plane, but on a curved surface, an ellipsoid. You who have been in the mountains and wended your way around a hill, hoping to arrive at camp, realize how difficult it is to keep a curved course. The least deviation on a curved surface works havoc, not only on the location of our camp, but in our case on the position of D.

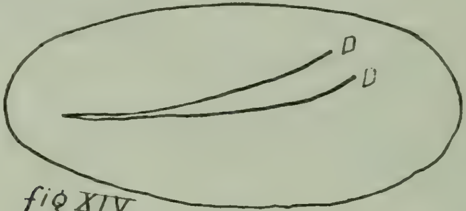


fig XIV

We must be fair to D's needs. He demands as accurate Graduations there as well as we. In the earlier part of this talk, I had shewn how D could be unfairly treated if we did not catch such insidious errors as shown in Fig. VI at the start. *A stitch in time saves nine* truly applies here. D. has a right to *complain* if we did not discover such errors as in Fig. VI and equally so has he if we treat him as lying on a plane or even on a sphere. D is a long way from us and wants us to know he lies on a curved hill that has the general shape of an ellipsoid. This placing of D in as true a position as possible by discovering Insidious Errors as in Fig. VI, by using Gauss's Mathematical treatment and by remembering that D lies on a special surface, the ellipsoid, the placing of D, remembering such consideration constitutes the subject of Geodesy. It is not the same as Land Surveying, as you see; it begins with the Land Surveyor's work (which work cannot stand without correction, however conscientious the Surveyor may be, not to make insidious errors) and in a Mathematical way treats all the Land Surveyors' errors and tries to locate D in his place on our earth (the Ellipsoid.) Now, gentlemen, all this (the placing of D) brings in difficulties for us. Given a certain place, a length 12 in a certain direction, it is no easy matter to place 2 exactly to $''.001$ in ϕ and λ on the Ellipsoid. If the earth were a sphere, the trouble would be lessened, but, on account of the variable curvature in cutting across an Ellipsoid, long series for getting ϕ, λ and α have to be employed. In the ϕ series, to get ϕ of the point 2, we often use 8 terms, in the λ series 10, and in the α series 12 terms. The result is that, if we start from a point and go around a triangle whose sides are about 80 miles (*e.g.*, Ham, Carmel, Yamaska) and compute the position of Carmel by our many term series on the Ellipsoid, and then use these values to go to Ham and finally to Yamaska, we always agree to $''.003$ in ϕ, $''.003$ in λ, to $''.003$ in α, and generally to $''.001$ in ϕ.

You will ask why such accuracy. Gentlemen, again I must draw your attention to the fact that all errors have a tendency to accumulate. We must be fair to D. To do so, the errors at our starting-point and even all through our work must be so small that their accumulated effect on D will be very small. Ever must we remember that we are trying to make a *Graduation*, and again I say a Graduation at D which D can use. We must always be on the alert to see how a small, perhaps insignificant error here works out at D.

For that end repeated solutions must always be made. It is a cardinal principle of Gauss' that as many errors as possible should be treated at once. Ideal distribution of errors is always dangerous when a small number of errors are used, and are just the more reliable as our number of errors to be considered is increased. I have shewn before the dangers of a triangle and quadrilateral adjustment. The number of errors to be considered is too small, the adjustment too ideal. Our desire to get away from ideal solutions producing distortion is *the* reason we solve in *nets* (see Fig. X). It is also the reason why, even though we solve in a net, we perhaps solve it all over again when new data is given us. We solve all the old and new together, so as to include as many field errors as possible, as Gauss in his Mathematical treatment advises. And we do this, in every case, to make our adjustment at D as near the truth as possible, so that D can get his Graduations and can rely upon it as a trustworthy friend. Again I say we must be fair to our distant friend D.

You will probably ask, where is the limit to these repeated solutions. There is no limit in reality, only the size of the task, our ability to do it, is the limit. But you will say, does not an extra base naturally limit the number of errors to be considered, *i.e.*, would we not adjust from one base to another base as in Fig. XV. This in many cases is the general size of the net to be adjusted, (from base to base). Much good as a base does in checking the length, yet just as an *ordinary ruler* may be apparently accurately graduated and yet have gradual imperfections, so can this net be in error. A ruler, *e.g.*, may have a twist or a bend in it, which it is impossible to discover in a small section of it.

This subject of *twist* or *bend* in a net is very hard to get out. You can easily see how it will most probably enter if we use only a base control.

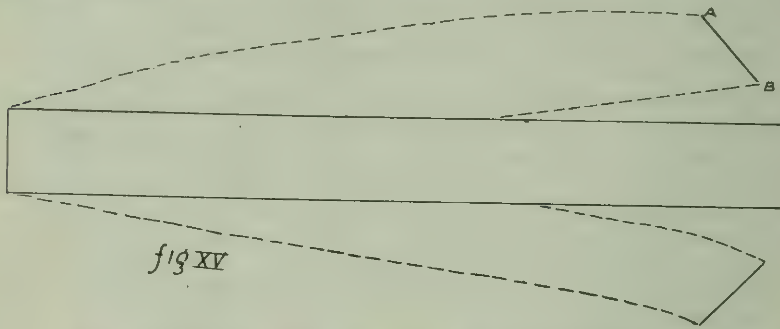


fig XV

When you check on a base, you do not say where the base is. It may be at AB or CD. All you do is to make the net meet on a length = AB. You do not say *in what direction* the triangulation shall go to meet on CD.

You will perhaps say, why not observe an α at D. But when you remember that it is a fact that the *Plumb Line is deviated at every place, i.e.*, that man does not stand really straight, shall I say, but thus at Z

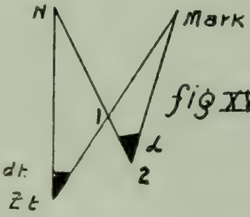


fig XVI

so that the α of a mark is not α_t as it should be, you will see at once that you cannot make use of an observed *a* as a check on a triangαlation. If you did so you would run the chance of doing more harm than good to a net. *But if at D* we observe for α (which includes an error in it depending upon the deviation of the Plumb Line as you see from the above figure), and if at the same time we observe for Telegraphic λ (which also includes an error depending upon the deviation of the Vertical), then it is possible to eliminate the Deviation of the vertical between the α_o and λ_o and we get a relation between α_o α_g λ_o λ_g which, as no doubt you know, is called a Laplacian Equation.

Gentlemen, I cannot too highly speak of the great importance of Laplacian Equations. They are our great friends in tending to take out the twist or bend in nets. Mind, I do not say they take it out absolutely, for that we do not know; but the Probability is (again I use the word Probability) that the twist and bend has been taken out and that by doing so we have been fairer not only to D but to all neighbors between 1 and D, so that, in place of the net bending as in Fig. XV, it goes, most probably, as it should. While the theory of Laplacian Equations was first discovered by Laplace in 1799, it remained for Dr. Helmert in 1880 to shew how to apply it to the straightening out of triangulation nets. This beautiful theory he has written in his "Hohere Geodesie," and, as time goes on, the geodetic world including all practical men who desire the accurate Graduations of not only this country but other countries, will more and more appreciate the work Dr. Helmert has done in this respect.

So far we have not had a *chance to use* Laplacian Equations. The point Murray is being observed for α and telegraphic λ and hence we will be able to adjust our scheme from Mt. Royal to Murray, not only by checking on another base (near Belleville) but also by using a Laplacian condition. I feel sorry that I have not results to shew you the healing effects of a Laplace Point to take out Twist from our triangulation. The station Murray is a Laplace Point, *i.e.*, a station where

The λ_o is 77° 39′ 59″.88
The λ_g is 77° 39′ 55″.35
The α_g is known but I have not the α_o.

This is the Modern ideal way. All other countries in the beginning of their work have (to carry accurate Graduations), only checked on bases, for it was not until 1880 that Dr. Helmert shewed how to use the Laplacian control. Thus the majority of nets in the world suffer from twist and distortion. Only too well do our conjoint Geodesists of the United States realize that in many parts of their triangulation twists of 6″ to 10″ exist, and that most probably these could have been taken out if the Laplacian Equations had been used before 1880. So it is in Europe where Dr. Helmert is working. There, the nets are based on many data (in place of one data as ours and the United States' are where they are placed on the N. A. Datum) and you can easily imagine how these data clash as they overlap; neither is the twist in each net as yet eliminated. So grievous is the situation in Europe that to Dr. Helmert has been relegated the task of straightening up the graduations of the whole of Eurpoe. As head of the Geodetic Institute and Central Bureau of Geodesy, Dr. Helmert is assisted in this stupendous work by trained geodesists, Dr. Kruger, etc. His endeavours to straighten out all this field work, past as well as present, to put all on one data (that from Greenwich), and to take out *twist* by Laplacian Equations, has made him the World's Authority on Geodetic Graduations, and as such he is viewed not only by Europe but by this country including the United States. He is the standardizer.

By the use of such Laplacian Equations, we hope to begin our Graduations from Mt. Royal to Bellevue in a way that will avoid the pitfalls of other countries, who, previously to 1880, did not have such an opportunity. I therefor believe that our country will be the first to start its Graduations on this scientific basis.

Thus you see that, though all the clashes of our nets between Mt. Royal and Murray have been apparently taken out, and though we have up to the present thought our results at D were fair to him, yet we would not be doing what is right if we did not *work* the whole thing over *again* with *Laplacian control* so as to give D and all D's between Mt. Royal and Murray the most reliable graduations possible. Ever must we be fair to D, no matter how many times new data, new Laplacian Points, etc., enter.

Though new base lines and Laplacian Equations are the great aids in adjusting large nets and so in giving the most probably accurate graduations at D, still other check aids will come to us in time. For example, our Lake Superior triangulation (which is

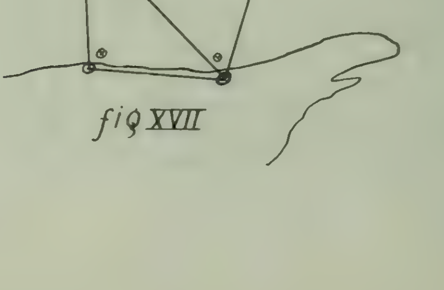


fig XVII

also based on the N. A. Datum, *i.e.*, from Meades Ranch) may in time meet our triangulation from Georgian Bay. A clash is bound to result. Thus the triangulation that starts from the *given fixed points*, Mt. Royal and Bellevue must fit in exactly on the *fixed points* St. Ignace and Isle Royal.

This introduces further conditions which tend to benefit intermediate D, D_1 graduations between Isle Royal and Bellevue. Need I say that all the triangulation between Mt. Royal and Bellevue should be adjusted in *one* whole.* If the true positions of Isle Royal are indicated by the black dots, as shewn in the above figure, and if the triangulation coming from Royal-Bellevue (even though it had been adjusted as a whole) were to be plotted as shewn and therefore would not fit into the true points Isle Royal, etc., you can see that it will take quite a number of conditions to be applied to a complete new solution in totality to make all fit into the true positions as indicated by the black dots.

I have used the word "Conditions," gentlemen. This opens up the question of the two modes of procedure in adjustments. Though we apply Gauss's Mathematical treatment of errors, of course, in both procedures, and though we arrive practically at the same conclusions in both, yet the method of using them is radically different. In the first method, called the Method of Conditions, all Conditions (and in large nets there may be as many as 200) are first satisfied so as to form a rod-like structure totally devoid of clashes, which structure is finally bent to the peculiar shape of the ellipsoid. In the second method, called the Method of Co-ordinates, very close positions of the points are first discovered,

and then from the observations final positions of the points on the ellipsoid by Gauss's Mathematical Theory are discovered. This Co-ordinate Adjustment is due to the genius of Dr. Helmert and in many cases is preferable to the Conditional Adjustment.

We use the Conditional Adjustment in the great majority of all preliminary work, especially if such conditions are easily found and picked out.

We use the Co-ordinate Adjustment in the majority of secondary work, which is *highly conditioned* by being fastened by Primary Triangulation, thus.

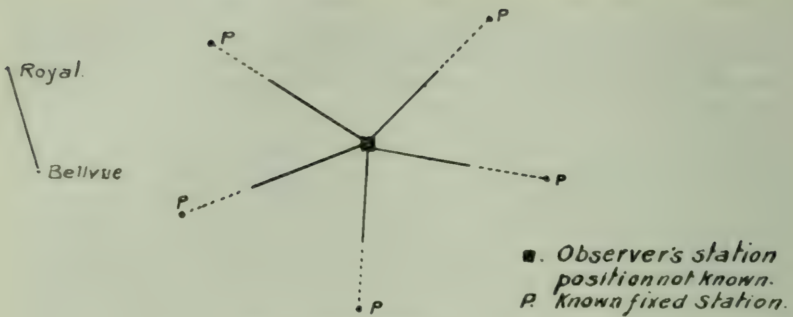


fig XVIII

We use the Co-ordinate to bring in "tying in" of triangulation on fixed points, *e.g.*, Isle Royal, etc.

We use the Co-ordinate to bring in Laplacian Conditions.

We use the Co-ordinate to obtain the Probable Errors of our Graduated ϕ, λ and α.

This brings up a very interesting subject. In the Net Royal to King Mountain the adjustment was done by Co-ordinates, and I may say that this is the first large net that we have done by the Co-ordinate Adjustment.

TABLE OF PROBABLE ERRORS OF ϕ, λ, ETC.

Probable	Error	of	length (12-11)	=	.082	meters.
"	"	"	" (14-16)	=	.189	"
"	"	"	" (17- 1)	=	.402	"
"	"	"	azimuth 2 a	=	.130	seconds of arc.
"	"	"	" 9 a	=	.353	" "
"	"	"	$\phi4$	=	.002	" "
"	"	"	$\phi17$	=	.007	" "
"	"	"	$\lambda2$	=	.007	" "
"	"	"	$\lambda16$	=	.023	" "
"	"	"	Base	=	.004	m.
"	"	"	13 x Base	=	100 X Probable Error of Base	

To this latter statement, gentlemen, I specially draw your attention. It at once shows how the errors are accumualting, *i.e.*, growing, in fact it shews that these errors are growing much more rapidly than the length of the triangulation, which is very nearly equal to 13 x the base. This length is represented by the Hypothetical Red line Mt. Royal to Murray, a Hypothetical line but a line of which not only the real distance and azimuths are known, but also the Probable Errors in length, etc. This statement cannot but arouse in your minds the enquiry, what might be the Probable Errors in length and azimuths of other very much longer lines. These unfortunately we do not have, but we hope as time goes on to attain such as such are so much more directly handled by the Co-ordinate Adjustment.

You will see by the table that we have been able to give the Probable Errors in ϕ and λ at the points as well as the Probable Errors of the α and all the distances of the same lines, also of the Hypothetical Line Royal-North Mountain. This I consider very interesting. How often we hear the Astronomer say he can observe his ϕ with a Probable Error of only $''.010$ and his λ is perhaps $= .010$ s. of time, and we can almost hear him say that, if any work were to meet on his point and not come within the limit $''.010$ of ϕ or .010 s. of λ, the error is not mine. In other works the field *Astronomer* knows and feels *certain* what his Probable Error is and can give a value for it.

So far as I am aware, gentlemen, the accuracy of a triangulation has nearly always been expressed by saying that the probable error of any side for example is so much. Nothing is said re the probable error of the position of a point. Very often the Astronomer and the general public ask—Well, how close do you think the position of point so and so is. Generally we say we think it is pretty close but we give no definite amount. Now the Co-ordinate adjustment *gives this information*. It tells at once what the probable error of the ϕ and λ of any point is, as well as the probable error of α. Thus is indicated where *strength* lies and where weakness lies. This is the great function of probable errors. Thus from the table of probable errors of the figure Royal-King Mountain, see just where strenght is and where weakness is. Also from the map of the Quebec Graduations you will see where strength lies. On strong lines we can afford to build up weaker triangulation; so as on weak lines, *e.g.*, we must build up a strong system not to perpetuate weakness. Thus Probable Errors advise us where strenght exists and where weakness exists, so that we can advise the field that care ought to be exercised here, or

And I say unhesitatingly that, if these adjustments had been done by small figures similar to Fig. VI, great distortion would have gone through, and the probable errors would have been much larger, *i.e.*, themselves distorted from the true ideal errors. I only wish such stretches of triangulation could have been worked out by small figures, to see what the exact distortion would be, but that would take considerable of the time of our staff, which, may I say, is at present only too small.

Gentlemen, may I make a brief resume of some of my past statements:—

(1) Necessity for Large Graduated Scale—to abolish Uncontrolled region.

(2) Necessity for care at the beginning of all Office work—to give real control to distant person D. Thus Insidious field errors must be corrected as in Fig. VI.

(3) Necessity for Mathematical treatment.

(4) Necessity for Large Nets instead of small figures—To fight the Arch Enemy Distortion. Ideal Solutions of small figures very dangerous.

(5) Necessity for knowing strong and weak points of our Graduations. By Probable Errors is this shewn so that new work can be gone ahead with.

(6) Necessity for Motto "To be fair by D."

I have tried to shew you how we try to graduate so at the beginning we will be fair to D, thus giving him a graduation. Thus by the Map you will see how our graduations were begun at Royal-Bellevue and we have tried to extend our Graduations to our distant friend below Quebec or to him near Amaranth. We have tried to serve the wants of accurate Graduations, of something to be relied on, the wants of not only these two distant persons but of many points between them.

But our Graduated ruler is, as you know, the whole of Canada (see Fig. X). It must be graduated in *sections*. Not only have we given Graduations, as I said before, from Quebec to Amaranth, but we hope soon to give Graduations around Lake Superior and in *British Columbia*. The graduations in British Columbia are very important as, by their aid, when they reach Alaska, the whole of Alaska will be straightened up for the Station Error, which I have mentioned before, and which I believe is very closely eliminated when we use the N. A. Datum.

Similarly you see the Graduators at work around Port Arthur and Lake St. Clair.

Gentlemen, I have started my paper by calling it "Geodetic Results and their Practical Meaning." With your permission I shall rename it the "Graduation of Canada and its Practical Meaning." Needless to say, we are just starting these graduations; it will take perhaps many years to graduate the whole of our country so that it will appear (See Fig. X).

I have said perhaps too much about how we obtain these graduations and about what our working motto is, and have said too little regarding the needs for such graduations. The first demands made upon us for Graduations were made, as I said before, by the International Waterways Commission, in the person of Mr. Stewart. Thus he obtained the positions of Scotch Bonnet and Presqu'isle to enable him to establish the boundary line. Similarly the Chief Geographer of the Interior Department was given results to better his maps of Canada. And lastly the Militia Department was supplied at times with Graduation results to control their many small military sheets.

These are up to the present, I may say, the main people who have needed our Graduations. That there will be a continual growing demand for Graduations not only from the above named departments but also from the public engineers, etc., I am sure you can easily imagine. In fact, just as our country opens up will graduations be more and more needed as controls. And as time goes on, our "Graduated Scale" will tend nearer and nearer to that completed ideal which a Graduated Scale should have. The *completion* of these Graduations can only be brought about by the extension of the Primary triangulation and of the detail filling up the space on our Graduated rule by Secondary and Tertiary triangulation. When this is done and when our Scale is embellished with the information re *heights* between every two points, which will be the case as time goes on, and also when it has imprinted on it the work of the Geological Survey shewing the nature of the soil between all points (whether rock or otherwise), then will our Graduated Scale reach its fullest functions.

No more will it be necessary to put down preliminary surveys to locate the many new railroads, *e.g.*, the G.T.P., nor to find out an idea of the cost of such.

By consulting such Completed Graduated Scale, it will be possible to advise Parliament not only if it is feasible to construct such and such a road, not only how long it will take, but even the cost of it. And this all because we will know all distances, heights and soils by our ruler. Such, gentlemen, is the way preliminary Surveys are made in England and in other parts of the continent, that is, simply by consulting the graduated charts, and you can easily see how much the country is saved in both time and expense.

Or perhaps the country will demand information re irrigation problems. Can such a particular area, *e.g.*, in Western Canada, be irrigated from such a particular source. If so, how long will it take to do it and what expense will be involved.

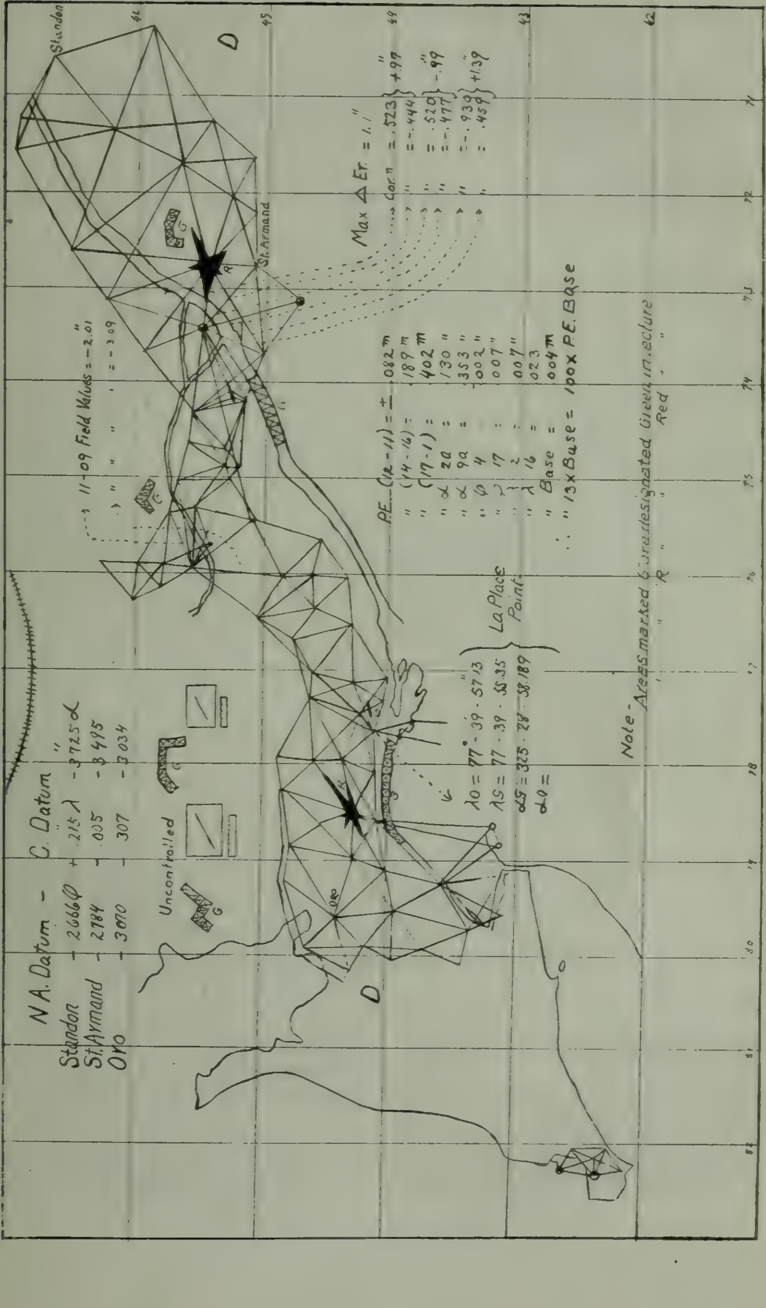
Or perhaps certain tunnels like the famous Simplon Tunnel in Europe are to be constructed by engineers. This example shews, not only how the practical public, the engineers will demand results, but also the need of the highest precision in the nature of the Graduations. Through a mountainous region, the distances and azimuths can not be given too accurately, so that, beginning in a certain direction to dig our tunnel, we should be able to meet exactly a party starting from D, say.

My lecture, while telling you of what we have done in serving the needs of the Naval, Militia and Geographic departments, has been, may I say, more an attempt to shew what we hope to do as time goes on. In Europe, Dr. Helmert has tried and is trying to straighten up the many overlapping systems there, *i.e.*, This work is very necessary as the country is more thickly populated and therefore needs more engineering feats.

That our country may in time be graduated so, in a similar way to serve not only the needs of the Chief Geographer, of the Militia Department and of the Naval Department, but also of the engineers in general, for all their various purposes, is our visionary hope.

And may I say in conclusion, gentlemen, that, while I fear I may have wearied you by this too long paper, I can only hope that you will approve of our motto, "Trying to be fair to the distant person D" in our required work so as to give him an accurate Graduation. I also hope that any of you who may be, at various places, this person D, will not forget that a large Graduated Scale is being prepared and continually enlarged and refined so that it will be in a measure as reliable to you (situated at D) as to us who are not so far away.

Gentlemen, I thank you for the honor you have done, not only to me, but to the office, in asking me to read this paper, and for your patience in listening to the same.


N.A. Datum - C. Datum
Standon + 2666 φ + 215 λ - 3725 α
St. Armand + 2784 - 005 - 3495
Oro + 3070 - 307 - 3034
Uncontrolled
G
R
Oro
D
Standon
St. Armand
11-09 Field Values = -2.01
" " " = -3.09
Max △ Er. = 1.1"
corrn = .523 } +.97
= -.444
= .520 } -.99
= -.477
= -.939 } +1.39
= .459
P.E. (12-11) = ± .082 m
" (14-16) = .189 m
" (17-1) = .402 m
" α 2a = .130 "
" α 9a = .353 "
" φ 4 = .002 "
" λ 17 = .007 "
" λ 2 = .007 "
" λ 16 = .023
" Base = .004 m
∴ " 13 × Base = 100 × P.E. Base
λ0 = 77° - 39 - 57.13
λS = 77 - 39 - 55.35
αS = 325 - 28 - 58.189
α0 =
La Place Point
Note - Areas marked G are designated Green in picture
" " R " " Red
45
44
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Enthusiastic applause followed the reading of Mr. Tobey's paper.

The Chairman: I think Mr. Tobey has his reward already—he is certainly an enthusiast and has gone into the question very thoroughly. If anyone would like to ask a question, it is now open for him to do so.

A Member: I would like to ask if there are any figures that give the maximum or mean standard?

Mr. Tobey: I may say we have no figures as regards the maximum or minimum, because in order to get such values you must know the standards between the astronomic and geodetic. The Americans believe that stationary errors at each place are very small and we only have one or two clashes. At Vankleek Hill. the clash is less than 2.800. I may say it ranges considerably all the way from zero to 30 seconds, and it changes very rapidly in various parts of the country. In Rochester, at one place it is nothing, and yet forty or fifty miles on it is about 10 seconds.—I do not know the cause—it is due to the refraction underneath the ground, and we have no records in Canada which state what it is, except in the case of Vankleek Hill and Murray. Outside of these there are none that I know of.

Mr. Shanks: I was a little afraid you might ask me to say something about the question of transportation, as it is one in which I have not taken much interest, but the geodetic survey is always one of particular interest to me. Two years ago the geodetic surveyors erected a signal near my father's home, and on each occasion when visiting the old folks the farmers around were inquisitive enough to ask the reason for all this, and knowing that I had some pretentions to scientific training, they thought I knew all about it—and the country girls were very particularly interested in the good-looking surveyors who were unfortunate enough to have to work all night and couldn't attend the country dances. I must say I could not make explanations as to the practical use of geodetic surveys—while I endeavoured to look wise and give them some explanation I fear I failed to convince them, but by this paper I hope to be able to, for I hope it will be published, and I will take occasion to send down some among those who were asking questions, and when they understand about getting "D" out of the trouble and throwing out a helping hand to the people at Lake Sinclair, they will understand the vast benefit of this work.

Seriously, I think Mr. Tobey deserves the warmest thanks of the Association. He has given this subject special study for which he is particularly well qualified. I had the good fortune of knowing him at Toronto University, and knowing of the esteem in which he is held there for his abilities in this particular line, and I know he has made a better success of his work, in connection with the geodetic work in Canada.

I have much pleasure in proposing a hearty vote of thanks to him.

MR. HERRIOT: I second that.

MR. CHAIRMAN: I am glad that after that paper Mr. Shanks will be able to go home and visit his friends in peace. (Applause).

SECRETARY HUBBELL: For the information of gentlemen who were not here yesterday morning, I might say that we concluded the programme as submitted, but when the programme was made, I held off, expecting some additional papers, and some changes have to be made. The aim was to get those papers on transportation and to have the men who wrote them to read them—it is very satisfactory to have those gentlemen who took the trouble to prepare them, read them; we received papers from the Yukon and British Columbia also,—those papers were read yesterday morning, one on the transfer of Natural Resources, by Mr. Dickson, D.L.S., of Whitehorse—which will be embodied in the next annual report, and judging by the number of papers, we are going to have a large report. Last year we sent to every member of the Association and others, something like 600 reports, so that we are getting pretty well known. I also read a paper yesterday from Mr. Brownlee, D.L.S., on Arctic and Antarctic Exploration. It will be published also; As we requested these gentlemen to furnish them, and now have the opportunity, I think the Association ought to place on record appreciation of their efforts.

I therefore move a vote of thanks to Mr. Brownlee and Mr. Dickson for sending these papers to the Association.

MR. HAWKINS: I second that.

Motion carried unanimously.

SECRETARY HUBBELL: This afternoon we have, as our programme states, a paper by Mr. William Pearce, D.L.S., on the "Survey of River Lots in Manitoba."

It is a long paper, and valuable, but I think if the members have no objections, we will embody it in our reoprt, and continue the reading of the remaining papers on Transportation. I would like to call the attention of the members to Article V of our Constitution, which states, that the "Annual Meeting of the Association shall fall on the first Tuesday in March,"—this is rather unfortunate as it is necessary for us to have our Annual Banquet on that evening, and some of the members object to have it on a Wednesday during Lent. I also think it preferable to have the banquet on the last evening.

THE CHAIRMAN: We can take that up this afternoon. The morning business is now over, and I trust as many as possible will come along this afternoon and bring your friends, so as to have a rousing windup of our proceedings.

The session was thereupon adjourned.

AFTERNOON SESSION.

The afternoon session opened at 3 p.m. with Mr. Aylsworth in the chair.

CHAINING.

By A. H. Hawkins, D.L.S.

It is proposed to treat this subject from the stand point of the general practitioner, with some reference to the work in connection with base lines as at present carried on by the Department.

Sometimes it has appeared to the writer, that this very important part of a survey is lost sight of and while instruments required to keep a good alignment and ascertain the azimuth with a very high degree of accuracy are being constantly improved, it would appear that only a very limited attention is bestowed upon the matter of the measurement of the line, and yet I am compelled to think that the proper length, is quite as important, as either azimuth or alignment, and although we have gone a very considerable distance in the way of improvement since the link chain, from which it was necessary to remove one or more rings every week to the four and eight chain tapes of 1-8 inch width at present used.

It would however, almost seem to be the opinion that trained men are not necessary for this part of the work: that a man who was little or no use with an axe, or some friend who was out for the benefit of his health (and he usually finds it), is the proper person to assist with this very important part of a survey.

A good chainman is of very material assistance to a surveyor, and to be efficient, he must be truthful, careful, patient, always watchful, and have the matter in hand always uppermost in his mind, and have a good working knowledge of the system of survey, so that he may when necessary lay out road allowances or mounds, as may be required.

A man with the above qualifications will not break his chain, or forget his road allowances, or give wrong chainages, for triangulations or offsets. He must be able to take the necessary topographical notes, in a legible, accurate and workmanlike manner, read and record clinometer readings and reduce them, read and record readings of both thermometer and barometer. He must know how to make and mark the wooden posts necessary to mark the progress of the survey, and be willing to spend twenty minutes to half an hour every night checking over his day's work, generally with the chief or one of the assistants, but alone if necessary, the most important of these requirements is probably that he shall be thoroughly honest.

With these necessary requirements it will be readily seen that it is exceedingly desirable that chainers should possess attainments somewhat above the average of the ordinary labourer, as the accuracy and success of a survey to a very large extent depend upon how it is measured. That being so it is suggested that an assistant be appointed to take over this part of the work, and I have on several occasions met with articled pupils who were really deficient in knowledge, as to this very important part of a survey, as generally at the present time assistants are engaged in either levelling, or transit work, and a man might easily put in his time and have little or no practical working knowledge of the manipulation of the long tape, which can be obtained only by a considerable practice.

In subdivision work, a 1-8 inch four or five chain tape is the best length, each chainer carrying a plummet and the head chain man a clinometer and note book as well, with the slope corrections and there are of course, eleven pins of small steel wire with a strip of red cloth attached to the ring of each one, the bottom of the pin being the point always used, *i.e.* where it enters the ground. The chainers should always try to be in sight of the transit so that all posts may be properly aligned, and they are then on the ground to measure any required offset or a base for triangulation and should the chopping be heavy, are on hand to help with the line.

It has been the custom of the writer to select from the labourers hired, the men who will in the greatest measure fill the requirements mentioned, and is sometimes very difficult but were it possible to have chainmen specially mentioned as to qualifications it is thought it would be of lasting benefit to both surveyors and Department.

The surveyor is supposed to check his chain at frequent intervals with his standard and while this is carefully looked after on the base line, it is thought that even the most careful methods available in the field, are not as exact in producing as uniform a measurement as could be desired and especially is this true in base line work where there is a check in about each three hundred and fifty miles. While the double chaining tends to eliminate any gross errors, there would appear to be a danger of a residual error always in one direction unless the chain were tested with the most rigorous methods, and it is suggested that for base line work that a laboratory test should be used both before the surveyor starts the work and on his return and it is thought that some very valuable information may in this way be obtained as to the distortion of the chain during a seasons operations and possibly lead to a surveyor carrying two or three sets of chains for a season's work.

In the measurement of base lines the method employed is somewhat more rigorous than on subdivision. The choppers are required when at all possible, to throw trees off ,not across the line, and willows and brush when cut must be thrown to one side thus preventing the chain being caught and giving the chainers a much better chance, as well as making the line a much better place to walk along.

A four or five chain tape is uesd for the lead chain, and all monuments are planted, road allowances laid off, and notes of topographical features taken with it, and the checking is done with a three or five hundred foot tape.

The chainers are both taught to take notes, and read slopes, when possible; one man leads with the link chain, the other with the foot chain and these positions are changed each mile, which arrangement I think, tends to eliminate any fixed personal error always in one direction, owing it may be, to some natural peculiarity of the chainman. Both men use plummets, from twelve to fourteen ounces in weight, and eleven pins are required.

Tally pegs are required every eight or ten chains as the case may be, thus giving a ready check in going over the line to notice any large error, such as four or five chains as well as being a very material assistance to the leveller in locating accurately, points requiring to be noted. All creeeks, tops of rises and other prominent features as well as the levellers bench marks, are ,marked by distance pegs as chained.

The chainmen are instructed to take all the time required to have their chainage accurate, and their notes both full and legible, as discrepencies discovered when the party are ten to twelve miles distant are rather troublesome.

The question of the best width of chain to use is worthy of some attention, but the lighter weights are the more favorably regarded, the 1-8 inch width being well thought of, and I am unable to see the advantage of the wider varieties; while the stretch may be less the weight is greater, requiring more pull to bring it approximately taut, and the more strength the chainmen is exerting while taking his measurements, the less accuracy is obtainable on account of the greater tension on his muscles. With the lighter weight, less strain is required to draw the chain taut, and the chainman is thus able to mark his position with more accuracy.

The pull necessary to put upon a 1-8 in. five chain tape is probably about twenty pounds, at least that much, and on a line that is comparatively clear this pull by no means takes up the sag, but what is left would be a fair offset to the stretch and the exertion is not so great, but that the chainers are able to mark the required position with considerable accuracy with his plummet, while on the other hand, with the heavier ¼ inch, the weight of your chain is doubled, and in order to draw the chain taut, your chainer must exert considerable more strength before the tape is anything like as free from sag as the smaller sized chain.

A small repair kit should always be carried by the surveyor, consisting of a dozen sleeves, solder, a small flat file, small pincers, three square inches of emery paper and a small phial with a glass stopper to contain one to two ounces of tinners fluid or hydrochloric acid nutralized with zinc.

When a chain is broken, the broken ends are carefully hammered flat and should a tag be adjoining the break, it is removed with the file. The ends to be joined are cleaned with emry paper and fitted into the sleeve, taking care if the break is at all jagged that it be properly fitted. When all is preapred, the broken ends are dipped into the tinners fluid, and a drop is introduced into the sleeve. Then place the ends carefully in the sleeve, taking care that the ends are properly together. Two or three small shavings of solder are placed on the sleeve and a candle is carefully held underneath the point to be mended and as soon as the solder is seen to run, remove the candle, otherwise the metal of the chain is burned. With care and the appliances mentioned, a tape may be repaired in ten minutes so that the loss of time is by no means so serious as the damage to your chain, that is in changing its absolute length.

The question of errors due to pull, sag and temperature, is very complex indeed, and especially the question of temperature is divisible into a great number of parts such as proximity to ground, bright or dull sky, proximity of snow banks, chain wet or dry, or partially shaded and part in the sun.

The errors due to pull and sag are of course to a large degree compensating, but should your chainmen feel particularly vigorous he will probably use a pull of thirty to forty pounds, in place of twenty, and on the other hand, should he be depressed, is quite likely to put too little strain on in making his measurement, so that altogether the question presents an extremely varied and complex proposition to the chief, who, at the best can hope by very diligent watchfulness, to reduce the sources of error to the smallest amount possible, and hope that the errors may in a large measure be compensating, so that the accuracy of his measurements may approach that of his azimuths, which with the instruments now in use is reduced to a very great degree of accuracy.

Johnston says, "For an accuracy of one in five thusand, the tape may be used in all kinds of weather, held and stretched by hand, the horizontal angle and amount of pull estimated. The temperature may be estimated or measured by a thermometer carried along, on uneven ground the end marks are given by a plumb line."

For an accuracy of one in fifty thousand the mean temperature of the tape should be known to the nearest degree. The slope should be determined by stretching over stakes, or on ground whose slope is determined, and the pull should be made by spring balances. The work being done in cloudy weather. For base lines the five thousand is too great an error, while the fifty thousand is of course rather too exacting for the manner in which they have to be laid down, but consideration being had for the methods that have to be employed, some point between these extremes could be reasonably expected.

To attain the best results then, it would seem that the following would be a good method of procedure, viz.: careful instruction of chainers as to pull, use of thermoneter, clinometer, plumbline, care as to alignment, and that the surveyor has succeeded in having his chainmen interested in attaining the best results.

With these matters all carefully looked after, it is thought that one in twelve or fifteen thousand is not too much to ask.

A good approximate value for the length the chain is difficult to obtain in the field. Generally, the surveyor begins his work while there is still snow on the ground and ice on the lakes, ponds and rivers, and quite aside from the discomfort of cold fingers, the wilderness presents many obstacles, before even a very ordinary approximation of the length of your field tapes is obtained, and for base lines, if a laboratory test were possible, it would be much more accurate and satisfactory and tend to greater uniformity throughout the system, and by using two sets of chains, one set could be returned to the Department to be tested as often as was found to be necessary.

The temperature as at present used, viz.: ¼ link to each ¼ section for each ten degrees F. is probably as near as may be given unless the co-efficient were determined separately for each chain and the difference would probably not warrant the extra work; however, it is to be remembered that whatever there is from this cause, it is largly accumulative and should therefore be given the most careful consideration.

Conditions for determining temperature are anything but ideal, one half the tape may be in shadow, and the other in the sun the shaded portion might have a temperature of about sixty and the exposed portion could easily be eighty to ninety. Where there is snow or ice the conditions may even be more exaggerated as a part of the chain lying in the snow may be at freezing point and a part in the sun be at seventy to eighty. It is therefore to be readily seen that the matter of temperature is a most complex and difficult one to care for, and the best results can be attained only by the greatest care.

Co-efficients of expansion seem to have a faculty of having different values for different experimenters, and from different authors that I have been able to consult, there appears to be considerable difference in values. For example for steel tapes, the co-efficient is variously given as 0.0000048 to 0.0000070 for one degree F., and one author gives 0.000012395 for one degree, while another comments thus on the subject: "Co-efficients of expansion have seldom been found with great accuracy and a national standard is said to have had an erronous value assigned to it for ninety years." From this it would appear that there was rather a large field for investigation before this very important subject is reduced to a somewhat greater accuracy than at present exists.

Perhaps one of the most serious of the constant errors, that may be controlled, is the matter of alignment, and it is as a general thing much more difficult to control, with a short than with a long chain, for example, in using a sixty six foot chain, the front chainman takes his mark three links to one side the distance measured would be approximately 99.992 links or 0.008 links too short; whereas with the long chain if three links to one side his distance would be for three chains 299.985 chains or .015 links for the three chains or .005 for one chain, a matter of 1-3 of a link. Possibly the picketman is not as careful in setting his chain pickets, as often as they should be and the chainers may loose sight of their forward mark or a little carelessness may easily leave the front end of the chain three or four links to one side. Short pickets should be placed every ten chains, to be removed by the chainers after the line has been checked.

While it may be difficult for me to prove mathematically, some of the deductions presented. Still they are the result of a somewhat varied, though limited experience, and while I am prepared to admit, that some of my contentions, if put into a concrete mathematical form, would probably have more force Still I beg to point out, that while experience has demonstrated them fully to myself, to demonstrate them mathematically is a very difficult matter for the man in the field, owing to unfavourab,e conditions and want of time for careful experimentation.

Chairman: This has been a very interesting and instructive paper. Now are there any questions or remarks in connection with it?

Mr. Dodge: We, in the office, are anxious to get suggestions with regard to any changes which might be of benefit. We agree that the methods are not all that they should be, but opinions as to how they could be improved are varied. If there is anything we in the office could do to help you, we would be gald to do. I think that the errors are far more due to methods in the chaining, than to inaccuracies in the chain used. Every chain used is tested. The length and size of chain, to be used, the correction for its sag, whether there should be a wide or narrow chain, these are all questions that require a great deal of study.

Mr. Aikens: The best work I find is done when the men work mechanically, when they do not have to think. The front man and the rear man should be changed from time to time, thus avoiding any accumulation of errors.

Mr. Milliken: It is easy to see that there are many things which will effect the accuracy of the work. Variation in pull, to take up the sag, the temperature, slopes, bushes, and add to this, the torment of the flies.

Mr. Hawkins: You cannot chain accurately if the tape is too long. My impression is that 4 chains is as long as you can use with accuracy. The size of tape, light or heavy depends on the kind of men you have for chaining. For careful men who know how to handle a tape, the light tape is the best. With a very light tape, there should be some kind of spring balance to regulate the tension. The coast surveyors use a spring balance, held in a stick. The end of the stick is pointed and stuck into the ground, and the tension is regulated pulling the stick. Something might be done in that connection.

With regard to the degree of accuracy, 1 in 20 or 25,000, I do not think you can get more than that under ordinary circumstances.

Dr. Deville: I believe standard tapes should be checked with the standard, on all occasions previous to being made use of. You must not depend on absolute lengths as a big pull will produce elongation. There is a popular idea that anyone can chain. When a man asks a surveyor to take his boy along, and he is asked what the boy can do, the invariable answer is, "Why, he can chain."

Chairman: It all reduces to this that chainmen are born, not made. It all depends on the honour of the men. I think Mr. Hawkins is entitled to a vote of thanks.

Mr. Dodge: I have listened to the paper with a great deal of interest. I take pleasure in moving a vote of thanks.

Mr. Milliken: I second the vote.

Motion: "That the thanks of the Association be tendered Mr. Hawkins for his very valuable paper."—Carried.

Mr. Akins then read his paper on Transportation.

REMARKS ON BASE LINE TRANSPORTATION.

J. R. Akins, D.L.S.

The first thing to be considered in connection with the transportation is to get good men to handle it. The necessary qualifications of a packer are a knowledge of horses with a desire to handle them, and a fair knowledge of the woods; together a willingness to do all he can in advancing the work. An assistant packer should also be engaged; one who is capable of going out for supplies with a separate pack train, or getting them in by other means. The main trouble with packers as a class is that they consider themselves the aristocracy of the camp and want to do nothing else but look after the horses.

An important item in transportation in Northern Alberta is the pack train. Good horses should be purchased. It is not wise to buy a poor horse because he is cheap, because when it is needed most it is often not only useless, but an encumberance, eating more than its share of the feed and doing no work.

A team weighing about twenty-four hundred can render valuable assistance. The writer has used such a team for three years and would not care to be without them. They haul about 1½ tons to the work, and when the smaller teams get stuck they can pull out the load. They have been used on waggons, mowing machine and on a plough in making a fire guard around a cache. If the trail is hard they can pack 200 lbs. without trouble, but the packers generally use them as saddle horses. They are not good in muskeg, but now that they are used to it they can rustle about as well as the cayuses.

If the other horses are broken to sleigh they can be made to take along a considerable amount of supplies, but they should be loaded light so that they may travel quickly.

The next thing to consider is the supplies and outfit. Very little canned goods should be taken; there is generally enough water in the country without freighting in more. The supplies should be well packed in parcels of about 50 lbs. The cases should be covered with Hessain and the rest double sacket. The cook outfit should be selected with a view to durability and lightness.

Two rifles are enough in camp, and at least one of these should belong to the surveyor, who can loan it to anyone wishing to hunt.

Splendid pack boxes are made of wood fibre. They are light and durable, and they are especially good for packing stationery and note books, but would also be good for packing the kitchen outfit.

When the end of transportation by water or sleighs is reached, the men should cut down their dunnage. The extra amount can be left in a general cache and drawn upon as required. Mr. Blanchet gives a good description of the cache, but they can be made fairly waterproof by covering with moss and then with sods or soil.

The main object to be kept in view when figuring on the transportation is to keep the supplies in camp and the camp moved along the line without interfering with the organization of the line party. This is a prime factor in getting a good total of miles run by the end of the season, and thereby reducing the cost per mile. The cheapest method of doing this is the next consideration.

If sleighs can be used in getting to the work and pack-horses on the work the best time to leave for the field is about the beginning of March, so as to get the party and supplies to the work on ice and snow. The time for returning would be after the snow had fallen, thereby making use of sleighs each way. This may not hold in other parts, but is true of the Peace River District. When there are stopping places and a good road, the cheapest way to freight is by sleigh, except where the freight can go down stream, in which case scows can be used on the big rivers and canoes on the small ones. The objection to transporting a party by water is that they get to the work late in the spring, and if they come out again by water the season is short.

Mr. Blanchet, in dealing with the question of dividing the pack train into two parts, refers to the country in which he has worked. But the conditions in the Peace River district are different, and it is often advisable to divide the train. In the spring the cache is the heaviest, it is necessary to carry feed for the horses, and the horses are generally in their poorest condition. As the grass gets good the horses get stronger and there is no need to carry horse feed. If a double train is used the supplies, other than what is necessary for the first month, can be left behind and oats necessary for the horses brought along. By the end of that time the oats are getting less and the feed probably better. The line will then be advanced about twenty-five miles. Twelve horses could make the round trip in four days and bring up another month's supplies. The advantages, ,however, in keeping the cache up is that in soft country it would be more difficult to get over the trail when the frost is out. It also requires an extra man when the train is divided. If there is no trouble in placing the caches on the line, with the first about thirty miles ahead of the beginning of the work, it would be advisable *not to divide the train*, but to keep the supplies up. But it may cost *too much* to place the caches in this manner and the surveyor may be able to handle them himself much more cheaply by having them placed at points within reach of his line.

This is the case in the Peace River country. The river is the great avenue for transportation, and supplies can be transported cheaply by boat or scow along it to some known point, as an old trading post or one now in use. The line generally intersects, every few miles, old trails leading to these posts, which can be utilized in bringing the supplies to the work. Twelve horses can carry a month's supplies and can keep the camp supplied for 50 miles in poor country and one hundred where the trails are good.

It is a bad policy for a surveyor to trust to the owner of a private train to keep the camp supplied. Promises are never considered sacred in the north, and a surveyor may be placed in an awkward position when a certain date comes when supplies were to arrive in camp but none have come. If he starts out he may miss the fellow coming in, and if he remains he may not have enough supplies to get out. It is therefore desirable that, if possible, the surveyor should control his own transport.

Four pounds of oats per day for horses has been found sufficient for the months of April, May, November and December.

No matter how difficult the transportation, there is no line which cannot be run; it needs only courage and perseverance.

Secretary: The gentlemen who have been kind enough to give us their personal experience on "Transportation," appear to agree on the general principles laid down. I would like to ask Mr. Aikins, when he referred to a team of horses weighing 2,400 lbs., if he did not mean general utility horses? not pack horses.

Mr. Akins: Utility horses. Four pounds of oats a day is sufficient for the ponies in April, May, November and December. Other months require more.

NOTES ON PACK-TRAINS.

By A. H. Hawkins, D.L.S.

One very serious difficulty is securing a proper place and proper attention for the wintering of the horses. Too often horses are returned to the surveyor in anything but a fit condition for work, and valuable time is then lost in getting them into shape.

Before starting out to work the horses should be fed oats from a nose bag twice a day for a month. During the Spring months, if working they should be fed oats twice a day. This does not mean throwing a quantity of grain on the ground in various places, but feeding by means of a nose bag for each horse. The time occupied in putting thsee on and off the horses is small when compared with the derived benefits. Beside the fact that in this way each horse eats his own share, and only his own, it accustoms the animals to being handled, which is a very valuable adjunct in a pack pony.

Each pony should have its own saddle and , once properly fitted, this should not be changed. When saddling great care should be exercised to see that no folds or wrinkles are left in the blankets and that the saddle is firmly and properly set. When unsaddling the saddles and canvases or chromos which are placed next the horse's back should be piled together so that there may be no mixing when they are next wanted. Double and single blankets should be placed neatly in two separate piles, care being taken to have them lying smooth. They should be kept off the ground with a good foundation of small logs or sticks with mantles first spread over them. When all are neatly piled, with the saddles stacked alongside and cinches and halter ropes neatly tied, the whole equipment is carefully covered with mantles held in place by small logs. The canvases worn next to the horses back should be given a thorough washing about once every four or five months. Cinches should always be kept as dry as possible.

It is a good plan to stretch the cinches around on trees and air the blankets, chromos and canvases thoroughly. Sunshine is especially beneficial to all this part of the equipment. Saddles should be equipped with breast straps and breeching. In either swampy or hilly country these additions to the equipment of a pack horse very materially help him, causing the load to ride steadily.

As soon as the pach horses are unsaddled, the head packer goes over each back carefully, before he turns the horses out to pasture. Old sores are washed carefully and treated with carbolic ointment, new abrasions are washed and treated with gall cure, cut or snagged feet and legs are carefully washed and examined to see that no foreign matter remains in the wound, and then was carefully wrapped when this is at all possible. A little watchfulness will frequently prevent a horse from being crippled.

A very great deal depends upon the head packer. It should be a rule that the horses are to be looked after before the packer and his assistants look to their own material welfare. A packer who is interested in his work will look up the best feeding ground in the locality of a new camp and see that the ponies get there as soon as possible, that smudges properly fenced and covered are built ,and if necessary a trail cut out to a convenient watering place. Never, under any circumstances, should a horse be abuesd. A little kindness and consideration is repaid a hundred fold and saves much time when packing. A horse that is kindly treated will usually remain quiet while his load is being put into place and is easily caught when wanted at any time.

When feeding oats, care should be taken to see that the horses have access to an adequate supply of hay, as a diet of oats alone will undoubtedly lead to serious trouble among the horses.

Camp is moved every five or six days as a rule, and once the line is advanced as far as the camp, the explorer starts off to locate the next camping ground. With a good explorer and fair ground the trail can be located near the line so that the party may stop work on line an hour earlier and cut trail back to camp. If this procedure is followed for a couple of days it is not a difficult matter on moving day to complete the trail and still have a fair force on the line.

The crossing of a stream or river is always a more or less serious problem for the packtrain.. All small streams should be bridged if at all practicable, dry timber being used. After construction, notches should be cut in the logs and if any geavel is available, it should be thrown on the logs to prevent the shoeless horses from slipping. If there is no gravel a good coating of spruce limbs, held firmly down by logs placed along the ends of the brush, gives the horses good footing. A railing placed on both sides of the approaches and along both sides of the bridge, is very desirable.

When fixing a trail over soft ground spruce boughs or willows should be used but, if at all possible, the trail should go round all such obstructions. It is easier, both on horses and men. Never use corduroy if it can be avoided. If it must be laid down, see that the logs are well notched and brushed, as it is most trying on horses to walk with unshod feet on the top of small round logs laid none too closely.

The character of the soil should be carefully noted. Certain soils become horrible mudholes after two or three horses pass. Cut all the logs out of such a place and give the horses a chance. Where the ground is hard, a horse will step over a log as high as his knee, but this takes time, and it is better to cut such logs out. In small windfall clear all the logs right to the ground as the soil is there generally of a quicksand nature and soon becomes a mudhole. The small sticks if not cut out become a serious menace to the horses, cuts, scratches and snags resulting.

A fairly generous equipment should be carried for repairs of the outfit, and for the medical treatment of the horses. Some of the necessary articles are latigo leather for repairing or for making new cinches, thread and wax ,copper rivets, leather, baling-wire, punch for buckle holes, leather needles, a palming needle and shield. These last are required to quickly repair a ripped bag, mantle or blanket and are extremely useful. The head packer should always have them at hand. Other articles required are a syringe, a horse float, a hoof knife, pinchers and a rasp to keep the horses' feet in good shape, bluestone, gall cure, sweet nitre, carbolic acid, aconite, and about one to one and a half pounds of grease or oil per horse for fly protection.

In the general transport outside assistance should be obtained when possible, it saves the surveyor's horses and expedites the whole work.

CHAIRMAN: Are there any questions regarding this paper?

T. B. SPEIGHT: I have listened with a great deal of interest to all these papers and the instructive discussions. I would like to contrast the methods in Northern Ontario. There man is the beast of burden, and we are often 100 to 200 miles away from our base of supplies. The supplies are brought up by canoes. We have some very efficient men helping us, men who have worked for me for the past twenty years. The boss packers are held responsible for keeping the survey party supplied. We can carry half a ton in a canoe. We change the occupations of the men. For example, when the packers are having an easy time, they are sent to help the choppers. They help each other and I find that it works very well. Pack horses would not be practicable in Northern Ontario. Doing 1½ miles a day on an average is fairly good work. I have from 20 to 24 men in a party. There are five axemen. My boss picket man has been with me for the last 20 years. He gets $3.00 a day. The boss packer gets $3.00 a day. Most of the packers are Indians who draw $2.00 to $3.00 a day. Each year there are 10 or 12 men who are old hands and 10 or 12 new men. I take out more men than are required and do considerable weeding out afterwards. I cannot recall a year when we have run out of supplies.

I divide my party up, a picket man, two assistants (one with level and one with instrument), the chief should not have any particular job, but be wherever there is difficulty. A level man, rod man, cook, assistant, two trail cutters, three or four packers, explorer, assistant, two chainmen, canoe men.

At the rate of pay from $45.00 to $65.00 per mile, at 100 miles north of the transcontinental, you have to work to make anything out of it. There is no fixed place for the chief, but it is of great advantage to have a good assistant.

CHAIRMAN: It is a great pleasure to have our old friend, Mr. Speight, with us. He has perhaps the most experience of any man in survey work in Northern Ontario.

Mr. Dodge: I have listened with a great deal of interest to the papers of Mr. Akins and Mr. Hawkins, and I have much pleasure in moving a vote of thanks to these gentlemen.

Secretary: I second that vote and appreciate the trouble these men have taken in preparing these papers. The Association does not realize the work they entail. Allow me to thank these men personally for the kind assistance thay have rendered me in getting up these valuable papers. This transportation question is a burning one. Last year the cook was a weighty question. These papers will be printed in the report and it will be a valuable book. This Association is not like others: its influence extends from the Atlantic to the Pacific. The work of the surveyors has cost $17,000,000 since 1869, as represented by the sub-division of 8,000 townships. It would make a line twice around the earth if laid out side by side. The assistance of these gentlemen has been of great encouragement to me.

Mr. Shanks: The papers and discussion have been extremely practicable. I must say that I came to learn, not to teach. The papers have been given by men who evidently know their business, and show a great deal of careful thought. I am glad to see the efforts of the Association marked with so great success.

The vote of thanks was carried.

Election of Officers.

Secretary: Mr. Miles, the President, could not be at this meeting and the Vice-President, Mr. Aylsworth has made a most capable chairman. He naturally succeeds to the presidency. We want to elect a man active in the interests of the Association. Mr. Aylsworth has been a very active official and has assisted in the work of organization in every way possible. Much of its progress is due to his efforts, and I have much pleasure in proposing Mr. Aylsworth as President for the coming year.

Mr. Hawkins: I second that.

Carried unanimously.

Secretary: The Patron is a permanent officer. The Honorary President is elected annually. Mr. W. F. King, C.M.G., has been the Honorary President.

Mr. Dennis: I move that Dr. King be Honorary President of the Association.

Mr. Robertson: I second that.

Secretary: Dr. King is always ready at any time to do all he can to advance the interests of our Association.

Secretary: The next is the Vice-President. I do not think we can do better than select a man who has attended every meeting, so far as I know, and taken an active interest in the proceedings. I have great pleasure in nominating Mr. Hawkins.

Mr. Akins: I second the motion that Mr. Hawkins be Vice-President.—(Carried.)

Chairman: The next is the very important position of Secretary-Treasurer.

Members: Carried, carried.

Chairman: Few of us realize the amount of work which falls on our Secretary. When you see the amount of correspondence he has to deal with, it is marvellous.

Chairman: The Executive Committee has given excellent satisfaction. They are Mr. Robertson, Mr. Nelles, and Mr. Henderson.

Mr. Shanks: I move that they be re-elected.

Mr. Hawkins: I second that.

Member: Mr. Henderson has told me that he does not want to act. He is a very busy man, and I don't think it would be well to force this work on him.

It was moved that Mr. Dennis be re-elected in his place.—Carried.

Chairman: Our Secretary does a great amount of work. I think it is our duty to vote him a little honorarium. We only have to think of the great amount of work of organizing this dinner, sending out ballots and all the other work connected with the office. I think it would not be out of place to increase the grant of $50.00 this year to $75.00. You will excuse me for recommending it, but I will ask you to vote on it.

Mr. Hawkins: It gives me very much pleasure to move that $75.00 be voted to the Secretary for the very efficient service he has rendered the Association. We know he does not perform these services for any money we may grant, but it will be a slight recognition that we appreciate his services.

Mr. Robertson: I have much pleasure in seconding that motion. Few of us realize the great amount of time this position requires.—Carried.

Chairman: We should cut out a lot of the work in the future by appointing Committees to do some of the work that now devolves on the Secretary. There is a great deal of work in connection with preparing the programme, and the annual dinner means a great deal of arranging. We go to the dinner and we think that everything runs smoothly, but we forget how many trips had to be made to make the plans work out correctly.

It might be well to combine the two into one Committee to have charge of the programme and the entertainment. I would suggest, if you will excuse me, the names of Mr. Nelles, Mr. Dennis, and Mr. Wallace, to form this Committee. I know these men would do the work well.—Carried.

Secretary: I wish to thank the gentlemen who have done so much to make this meeting a success, in preparing papers for this meeting, and those who have assisted in the work of arranging this Convention.

Chairman: There has been some suggestions that there should be a change in the date of our annual meeting.

Member: How about the last Tuesday of February.

Member: That would be too late.

Chairman: Suppose we make it the last Wednesday in January.

Mr. Akins: I think that the last Wednesday and Thursday in January would be all right. I move that article 1 of paragraph 5 be changed to read that the annual meeting begin on the last Wednesday in the month of January, instead of the first Tuesday in March.—Carried.

Mr. Robertson: I would suggest hereafter that instead of passing votes of thanks at the conclusion of each paper, there be one vote of thanks passed at the completion of the meeting to cover all.

Mr. Hawkins: I quite agree with that, it would save much time.

Chairman: I have received a letter from the Secretary of the Library, stating that the bust of Earl Minto has been broken, knocked over by some person attending these meetings. We want to act like gentlemen. We have been granted the use of this room, and we must make right any damage done. I hope that any person who knows anything about it will make it known to us.

CHAIRMAN: I regard this as a great honour you have done me in electing me president of the Dominion Land Surveyors' Association. I wish in a most humble way to thank you for the honour you have done me. There is no other position that I would prefer. Although this has been the best meeting we have had since the Association was organized, we must strive to make next year's even better.

The Convention was thereupon adjourned.

On Wednesday evening, in the Lecture Room at the Dominion Observatory, an illustrated lecture was given by Mr. Noel Ogilvie, D.L.S., on the "Glaciers" in South Eastern Alaska. Dr. King, C.M.G., presided. This interesting and instructive lecture was highly appreciated by a number of the members of the Association, accompanied by their lady and gentlemen friends.

After the lecture, the various parts of the building were thrown open to the members of the Association and their friends, and an enjoyable hour was spent. Dr. King and members of his staff explained the working of the various scientific instruments and the problems that were under investigation in the different branches. The Dome containing the fifteen-inch equatorial telescope with its eye-piece, micrometer eye-piece, solar camera and stellar spectographs; the Instrument Room with its survey instruments of many kinds; the Record Room with its maps, etc.; the Time Room with its various electrical clocks, chronographs for recording time-sets, meridian circle and transit instruments in the Transit House; the Library with its numerous scientific periodicals, books and pamphlets; the Seismograph Room with its instruments and location for recording magnitude, character and location of earthquakes; the Solar Physics Laboratory with its eighteen-inch reflector, spectrograph, etc., were examined in turn by the groupe of interested visitors, and a clear knowledge was gained of the excellent character and great range of work that is being carried out (so successfully) in the Observatory by its enthusiastic staff under the direction of their beloved Director, Dr. King.

The Association appreciates Dr. King's kindness and courtesy in extending to them the use of his lecture room.

—E. W. H.

THE EARLY SURVEYS AND ADMINISTRATION OF LANDS IN MANITOBA.

By William Pearce
D.L.S.

CALGARY, ALTA.,
7TH JANUARY, 1914.

To the Members of the
Dominion Land Surveyors' Association.

GENTLEMEN:—

I have been urged for some time to read or have read before your Association, a paper on the early surveys and administration of lands in Manitoba, particularly in regard to the Settlement Belt or Parish Surveys. Surveys and administrations are so closely interwoven that it is well nigh impossible to separate them.

There is no doubt that neither the Government nor the public has to any appreciable extent recognized the invaluable work done by the pioneer surveyors of the three Prairie Provinces, particularly those engaged in the surveys of the first few years. Genuine pioneers generally do not receive the thanks and honors they are entitled to. The surveyors seem to have been completely ignored. It is worthy of serious consideration by this and similar associations whether it is not advisable or probably imperative that steps should be taken to remedy this condition.

Imagine the then conditions in comparison with those of the present as regards transport, rations, and camp equipment.

Consider the honesty and truthfulness of their reports of the country, and accuracy of work. Without such, settlement would have been a miserable failure.

Remember the loss sustained by the surveyors by the rate obtained. On block outlines men practically gave their services gratis for the first two years. One may search the Public Accounts and he will fail to find any vote of parliament to reimburse them for such loss.

That the country has been almost absolutely free from litigation over land lines is the strongest flattering tribute to those responsible for the system and the accuracy in carrying out same. Hundreds of thousands of dollars have been advanced them to make surveys and not one-fiftieth of one per cent. proved variant to the trust reposed in them. Can the same be said of any other class of men?

In addition to those hereafter specially mentioned, turn to the list of surveyors employed in the advance van of surveys down to the present, and it will compare most favourably with any enterprise in Canada or the world, and if honors went by merit, in that list would be found a very large percentage who are more entitled than those honoured because of political, manufacturing, transportation interests, or even those granted to those in diplomatic civil service, or prominent in educational acquirements.

LANDS OBTAINED UNDER THE MANITOBA ACT IN MANITOBA AND SURVEYS INCIDENTAL TO THE GRANTING OF TITLES THERETO.

Surveyors in the three prairie provinces, particularly Manitoba, by reason of the very large number of "Manitoba Act" claims, are to be congratulated on the standard of officers which have been at the head of the surveying and land administration operations from their inception down to the present, a very high standard not only of efficiency, but of honour, justice and fair play.

Particularly was this condition of affairs prominent at the inception of the surveys. As the first Surveyor-General, and afterwards as Deputy Minister of the Interior, Col. J. Stoughton Dennis commands high regard. To those of us who knew him his memory is "ever fresh and green," and from my first meeting with that gentleman back in 1869, till the last time I met him, shortly before his death in 1885, I always felt I had a friend. He would indeed be a low type of official who would not be inspired with loyalty to and the desire to do his utmost to carry out the wishes of, such a superior. He had to a marked degree the technical qualifications of a surveyor, but possibly in a more marked regard the administrative qualifications; a broad understanding of human nature, and he looked into questions not from a narrow administrative or technical standpoint, but from the broadest one. That the complicated system of land affairs was finally adjusted throughout Manitoba without doing injustice to anyone, is largely due to his direction.

The early stages of settlement by immigration into the Province was greatly stimulated by his administration. When one considers the conditions under which such settlement was placed, the advance, judged by present standards may seem slow, but when everything was taken into consideration, it was very rapid.

A man of splendid address and urbane manner, firm but conciliatory, he had very much to do in shaping legislation affecting Manitoba and the Northwest, not only in regard to the Department but many matters outside of it.

He was made Surveyor-General by Order in Council, March 7th, 1871, and was, on the 25th August, 1873, appointed Surveyor-

General of Dominion Lands on the establishment of the theoretical organization of the Department of the Interior at that date. He continued in the office of Surveyor-General until 14th November, 1878, when he was appointed Deputy Minister of the Interior, and continued in that till his resignation in 1882, when Mr. Lindsay Russell was appointed his successor.

In Lindsay Russell, who was connected with the surveys of the West from the time of the first Dawson expedition in the late 50's, and who very early in 1871 was brought into the Department of the Interior by Col. Dennis, and appointed Inspector of Surveys in July of that year, the surveyors had at the head of the Technical Branch a man who had very few peers in the world, probably not an equal at that time on this continent. As an astronomer, also understanding thoroughly the mechanism of all surveying instruments and the principles on which they were built, he could not be excelled.

A man thoroughly honest and upright in his dealings with his fellows, and whose severance from the Department in 1883 was a great loss. He occupied the position of Surveyor-General from 14th November, 1878, until his retirement on 15th November, 1883, and from 4th January, 1882, till June 7th, 1883, was also Deputy Minister of the Interior.

Though at first Mr. Russell was Inspector of Surveys, his duties subsequently were devoted to the directing of the field operations, particularly in connection with what afterwards developed into the Special Survey.

Mr. A. M. Burgess was appointed Deputy Minister of the Interior in 1883, and remained in that position till 1897.

Mr. A. H. Whitcher and Mr. Milner Hart were appointed Assistant Inspectors of Surveys on 8th May, 1872, and Inspectors on Mr. Russell's promotion to Assistant Surveyor General on the 28th February, 1873. Mr. Whitcher continued in that position till the 14th April, 1880, when he was appointed Dominion Lands Agent at Winnipeg. Mr. Hart resigned his position in, I think, 1877. They performed the duties of Inspectors of Surveys, Mr. Whitcher's duties being chiefly confined to the settlement survey work and office work arising thereout, Mr. Hart taking the inspection of the subdivision surveys. In both Mr. Whitcher and Mr. Hart, the office was filled efficiently and with dignity. Men of the strictest integrity, both were most approachable and sympathized with the surveyor and the settler.

On June 13th, 1881, Dr. Deville, the present Surveyor-General, was appointed Inspector of Surveys, on the 1st July, 1884, Acting Surveyor-General, and Surveyor-General on 1st January, 1885, which position he still most ably fills.

No attempt is being made in this paper to go into a technical report regarding surveys. In Part 6 of the Report of the Department of the Interior for the year 1891, will be found a very full and complete report of all surveys, and by whom made in the Province of Manitoba and the Territories, since and including 1868 up to the date of said report, viz.: the close of 1890. A very great amount of labor and care was given to said report by Mr. J. S. Dennis, then Chief Inspector of Surveys, now Assistant to the President of the Canadian Pacific Railway and the head of the Natural Resources Department of that Company. He devoted more time to it than I have available, and had the ability to give the subject much greater justice than the undersigned. His report is referred to in this so that those who are interested can no doubt obtain a copy thereof and peruse same. It is pointed out to your association that it would be probably of very great value and certainly of historical interest, if a considerable portion of this report were published for the members of your Association.

I have, therefore, devoted this paper largely to taking up a subject not embraced particularly in the report, and have only alluded to what is in it so far as may be necessary to render this paper intelligent.

It might be well, however, to give the following extract from that report. Speaking of Col. Dennis, who was sent to Manitoba to take charge of surveys by the Minister of Public Works, under instructions dated July, 1869, the report states as follows:—

"Arriving at Fort Garry in August of that year, the country bordering the Red and Assiniboine Rivers and vicinity was examined, and after giving due weight to the information received from those competent to advise on the subject, a system for the survey of the country first into townships and then into farms was drawn up, and, with illustrating sketches, was forwarded to the Government under date the 28th of August, 1869. The proposed system was approved, and was brought into force by an Order in Council dated the 23rd September, 1869, the Order in Council being based upon a memorandum from the Hon. Wm. McDougall, the then Minister of Public Works, who forwarded the proposed system and recommended its adoption.

The system adopted contained many points of difference from that now in force, and being of interest from an historical standpoint, it is here given in extenso:—

"PROPOSED METHOD FOR THE SURVEY OF THE PUBLIC LANDS IN THE NORTH-WEST TERRITORIES.

"1. The system to be rectangular; all townships to be east and west or north and south.

"2. The townships to number northerly from the 49th parallel of latitude and the ranges of townships to number east and west from a given meridian, this meridian to be drawn from the 49th parallel at a point say ten miles west of Pembina, and to be called the Winnipeg Meridian.

"3. The townships to consist of 64 squares of 800 acres each, and to contain, in addition, 40 acres, or five per cent. in area in each section, as an allowance for public highways.

"4. The townships on the Red and Assiniboine Rivers where the same had ranges of farm lots laid out by the Hudson Bay Company, to be surveyed, the broken sections abutting against the rear limits of such ranges, so as to leave the same intact as independent grants."

By the Manitoba Act, 33 Victoria, Chap. 3, assented to 12th May, 1870, the boundaries of the Province of Manitoba were defined as:—Bounded on the east by Longitude 96°, on the west by Longitude 99°, on the south by the 49th parallel, and on the north by 50° 30′ north latitude. These boundaries were amended by 40 Victoria, Chap. 6, assented to 28th April, 1877:—Bounded on the west by the westerly boundary of Range 12, on the east by the easterly boundary of Range 10, on the south by the 49th parallel, and on the north by the north boundary of Township 17.

The actual date of the transfer of Manitoba and the North-West Territories to the Crown, as represented by the Dominion of Canada, was the 15th January, 1871.

What is known as the Manitoba Act, which provided for the establishment of Government in the Province of Manitoba when Her Majesty the Queen might be pleased to admit that Province into the Dominion of Canada as provided for by the British North-American Act of 1867, became law on the 12th May, 1870. Section 32 of that Act recites as follows:—

"32. For the quieting of titles, and assuring to the settlers in the Province the peaceable possession of the lands now held by them, it is enacted as follows:—

1. All grants of land in freehold made by the Hudson's Bay Company up to the eighth day of March, in the year 1869, shall, if required by the owner, be confined by grant from the Crown.

2. All grants of estates less than freehold in land made by the Hudson's Bay Company up to the eighth day of March aforesaid, shall, if required by the owner, be converted into an estate in freehold by grant from the Crown.

3. All titles by occupancy with the sanction and under the license and authority of the Hudson's Bay Company up to the eighth day of March aforesaid, of land in that part of the Province in which the Indian Title has been extinguished, shall, if required by the owner, be converted into an estate in freehold by grant from the Crown.

4. All persons in peaceable possession of tracts of land at the time of the transfer to Canada, in those parts of the Province in which the Indian Title has not been extinguished, shall have the right of pre-emption of the same, on such terms and conditions as may be determined by the Governor in Council."

The foregoing was amended by Clause 3 of Chap. 42, 38 Victoria, assented to 8th April, 1875:—

"Be it enacted, that persons satisfactorily establishing undisturbed occupancy of any lands within the Province prior to and being by themselves or their servants, tenants or agents, or those through whom they claim, in actual peaceable possession thereof, on the fifteenth day of July, one thousand eight hundred and seventy, shall be entitled to receive Letters Patent therefor, granting the same absolutely to them respectively in fee simple."

An Order in Council was passed on the 20th April, 1876, extending to some extent the provisions of the Manitoba Act and recognizing a title for the following lands:—

"1. The lands taken up antecedent to a date six months previous to the transfer of the North West Territories to the Dominion, in accordance with the usage of the country as recognized by the Council of Assiniboia, such proceeding being to employ one of the two surveyors in the colony to survey and lay out the land."

The Minister goes on in Section 2 of said Order in Council to discuss a further class of claims known as staked claims. These claims were eventually recognized as coming to some extent under the provisions of the Manitoba Act, grant being free, or at most $1.00 per acre, and without script to the extent of $1.00 for each acre granted.

The Council of Assiniboia was a Council nominated by the Hudson's Bay Company, composed chiefly if not wholly of officials or warm friends of said Company, and had jurisdiction over land and many other matters within a tract of country within a certain radius of the junction of the Red and Assiniboine Rivers, and about the year 1836 certain lands were laid out under the direction of said Company along the Red and Assiniboine Rivers which correspond to what are now the parishes of:—

St. Boniface, east and west.
St. Vital.
St. Norbert.
Ste. Agathe up to Salt Springs.
St. Johns and Winnipeg.
Kildonan.
St. Paul.
St. Andrews.
St. James.
St. Charles.
Headingly.
St. Francois Xavier, east and west.

In addition to those recited the outer two miles were granted to St. Clements, hence I think it is probable a survey into river lots of that parish must have been made under the authority of the Council of Assiniboia.

The extension of survey into narrow lots was carried out also in the following parishes:—

St. Peters, which was largely an Indian Reserve.
Ste. Agathe.
Ste. Anne des Chenes, commonly known as Oak Point.
Little Point des Chenes.
Baie St. Paul.
Poplar Bluff.
Portage la Prairie.
Westbourne.
St. Laurent.
Oak Point.
Lake Manitoba.

In what are now known as the settlements of Lorette, Otterburne, on Rat River where it is crossed by the Pembina Branch of the C. P. R., and further up a branch of the said River in the neighbourhood of La Rochelle, narrow lots fronting on the river or some highway were laid out. These claims, however, were composed nearly wholly of staked claims. Some few of them had been surveyed by one of the surveyors authorized by the Council of Assiniboia. These settlements were never considered as parishes.

The two surveyors who are alluded to in the Order in Council of the 20th April, 1876, hereinbefore recited were Roger Goulet and H. L. Sabine.

The usual practise in laying out lots was to make them approximately two miles in depth, or the Indian measurement of two miles, the distance bounded on a level plain by a horizontal line of sight made under the belly of a horse. A good deal would depend on the horse. Originally the majority of the lots were 12 chains in width, making approximately a holding of 200 acres. These lots became sub-divided but invariably were sub-divided lengthways, so that they became, some of them, mere roadways so far as width was concerned.

This class of settlement corresponds with the old French settlements of Eastern Canada, and so far as the French half breed parishes were concerned, they no doubt followed the practises of their ancestors. The reason of such settlement is plain, viz., the Rivers were in the first place the general highways. Secondly, a considerable amount of food was obtained from the River, also the water required for domestic purposes. This consolidated settlement also enabled the inhabitants to readily gather together for defence in case of Indian attack, and provided social and other privileges which could not be obtained under the present system of settlement. In fact it is well worthy of consideration whether our system of settlement could not be modified somewhat on these lines with advantage to all parties and interests. Settlement also clung to the streams because it was a popular idea that on account of frosts nothing could be grown away from the beneficient influences of said rivers. When I first came to the country in 1874, I was solemnly assured by some of the most intelligent settlers in the parishes of Kildonan and St. Pauls, that it was impossible to grow grain back two or three miles from the river, and the parties who made such assertions honestly believed such to be the case. A very few years later, however, some of the larger farmers in the English speaking parishes stated to me that if when the land had been laid out in rear of them in quarter sections, they had gone out and taken up same and abandoned their river lots, they would have been very much ahead. They then realized the waste of time and energy in attempting to farm on a narrow strip.

In 1874 I found a party who owned and resided upon, occupied and cultivated, in St. Andrews parish, a strip of land one chian in width on both banks of the river. He had in all 64 acres of land, but it took a journey of eight miles to pass from one end of it to the other. In the same year the average width of lots in the parish of St. Andrews, extending along the east bank of the river some seven miles, was less than three chains. However, the writer understands that where farming is now carried on to any extent many of these narrow lots have been consolidated and converted into holdings in which the width is much larger in comparison to the length than it was during the years when he was familiar with the conditions.

In the laying out of these lots originally what was known as a base line was laid out which was established, generally speaking, parallel to the river and sometimes would extend across the entire parish, other times not. The width of the lots was established along it and the side lines were run at right angles to said base line. Owing to the sinuosities of the stream, particularly at the junction of the Red and Assiniboine Rivers, it was impossible under such a system to carry these lots out to their full extent and have them fronting on the said streams. In the Order in Council providing for the outer two miles Hay and Common rights, this condition of affairs is alluded to so far as the said outer two miles is concerned, and that provision was in practise extended to the lots the rear of which did not reach anywhere near the limit of the said outer two miles.

"And further, that as regards the claims of commutation of the rights of common and of cutting hay by the people in parts of the parishes of St. Boniface, West, St. Vital, and St. James, where the hay right on the outer two miles was cut off by the junction of the two rivers, as set forth in paragraph 3 of the Lieutenant-Governor's despatch, dated the 18th March last past, that the same be settled on the same principle, by which such people will be entitled to one dollar and a half in scrip for each acre of land in the river lots respectively owned by them."

Before passing on in this matter. I cannot refrain from alluding to one of the surveyors mentioned, viz.: Roger Goulet. It is probable Mr. Sabine may have been equally deserving of the highest praise, but not having had the experience with him, I cannot state. Mr. Goulet was a prince among men, thoroughly truthful and honest and he served the government faithfully until near his end, and saved the country property to the value of millions of dollars by reason of his probity. It is a source of gratification to the writer that he was largely, if not wholly, instrumental in having him placed on the Half Breed Scrip Commission in 1885, and in that capacity alone he saved hundreds of thousands of dollars to the public. As a surveyor he was much above the average of his day. There is one incident in connection with his life that I cannot refrain from mentioning. There are many cases of men being put in jail for striving after office, but his is the only case I have come across where a man was put in jail because he would not accept one. When the so-called Riel Government was formed in 1869, a very strong effort was made by the Riel party to obtain the co-operation of Goulet. His accession would have solidified or at least largely attracted all the better elements of the French Half Breeds and a very considerable percentage of the English also, but he would have nothing to do with them. They offered him the position of Minister of Customs. He refused. The result was they arrested him and put him in jail and kept him there for some months, thinking they would terrify him into acceeding to their request. In that they utterly failed. If he had been an aggressive man he could have been the leader among his people in Manitoba, and it would have been a grand thing for them if a man of his character had occupied that position.

At his death the undersigned made an effort to collect money to have a monument erected to him, on which it was suggested the inscription should be merely "Here lies an honest man." It is to be regretted that such an effort failed. Men who had been saved thousands of dollars in their transactions regarding half-breed land and scrip by advice obtained from Goulet, as to the character of the parties with whom they were dealing, would not contribute one cent. An emphatic illustration that "Gratitude is the sense of favors to come."

Half Breed Lands.

It might be well to make a reference to the Half Breed Lands. Under the Manitoba Act, 1,400,000 acres were set apart, the intention of parliament being that that should be divided among all Half Breeds, the heads of families as well as others, and it was assumed there were 10,000 of them in all, and it was intended that each should obtain 140 acres of land. 140 acres, it is stated, is a familiar unit for farm lots in many parts of the Province of Quebec, and it is presumed that was how the said area was arrived at. Later it was discovered that under the wording of the Act the heads of families could not participate in that. The heads of families were then granted scrip to the extent of 160 acres or $160.00 each. Lands then $1.00 per acre.

By Order in Council of 13th January, 1872, the Hon. Gilbert McMicken was instructed to take a census of the Half Breeds, and he evidently made one as the Government proceeded with the allotment, because it is found by an Order in Council of 7th February, 1874, that so far as the parishes of St. Boniface and Little Point des Chenes are concerned, it had to be rescinded. On the

21st May, 1874, the allotment of the parishes of Oak Point and Lake Manitoba was cancelled. These allotments were on the basis of 140 acres to each individual. In the report of the Surveyor-General to the Secretary of State, dated 30th June, 1875, the following appears:—

"HALF BREED LANDS.

"The division of the lands set apart by the 31st section of the Act 32 and 33 Vic., allotting to claimants 140 acres each, having been commenced was arrested pursuant to your instructions and the subsequent operation of the Act 36, Vic. Chap. 38 having necessitated a new allotment increasing the individual grants to 190 acres, the new division required is being made and no unnecessary delay will be allowed to interfere with the carrying out of the final distribution."

The writer is strongly of the opinion that not only was a division of lands made on the basis of 190 acres each, which he has seen, but that he has seen one on the basis of 210 acres each.

Things seem to have been allowed to drift, as we find that on the 26th April, 1875, a long memorandum approved by Order in Council is drawn up, which in view of what has already taken place is rather an interesting document. By that Commissioners were appointed to really take a census. They were to travel around from parish to parish, giving each parish public notice when they would be there so that all claimants could come forward and furnish their evidence as to their right to participate. (The same thing also in reference to White Settlers 'rights to scrip.) Before they completed their labors very considerable time had elapsed. The Commissioners were Mr. Machar and Mr. Ryan, commonly known as Judge Ryan, and the Secretaries, Mr. Forget and Mr. Goodhue. Mr. Forget afterwards became Assistant Indian Commissioner, then Lieutenant Governor of the North West Territories. He is now Senator for Saskatchewan and resides at Banff. Mr. Machar seems to have wound up his duties rather summarily as it would appear he was through his work in October of that year, but Mr. Ryan did not conclude his labors for a considerable time after that. It would appear that in March, 1876, the Government considered that matters were in such a shape they could then go on with the allotment, as at that date an Order in Council drawing up the regulations as to who should and who should not be entitled to scrip, was passed. It would appear that in June, 1876, however, Mr. Ryan was authorized to proceed to the North-West Territories to take evidence of the Half Breeds who were entitled to scrip in Manitoba, but who were then living in the Territories. On the 7th September of that year an Order in Council was passed stating that the report of the Commissioners had enumerated 5,088, others investigated by Mr. Codd, Land Agent, numbered 226, and 519 allowed as a margin for future claims, gave a total of 5,833, and that 1,400,000 divided by 5,833, gave 240, and it was decided to at once proceed with the allotment of the lands on that basis, 240 acres to each child.

The original grant of 1,400,000 acres was, however, not only exhausted, but a very large area in addition had to be given to the Half Breeds.

It would be most interesting to obtain the amount of land which was granted by the Dominion Government under the Manitoba Act, and under the White Settlers' scrip, either directly as land or in the shape of scrip. The scrip was granted at a time when land was $1.00 per acre, so that for $1.00 of scrip one acre of land was granted. If such were worked out it would be found that a very much larger percentage of the Province of Manitoba was devoted to the so-called quieting of the Half Breed and old settlers' rights than many people imagine. If in addition to that the cost of administration was added, and for each dollar so spent an acre of land was taken, I think it would be found that 80% would be so taken within the boundaries of the original Province of Manitoba, which after deducting roads, swamps, morasses and Indian Reserves (no allowance seems to have been made for portions of lakes Manitoba and Winnipeg), was estimated to contain 8,300,960 acres. In fact it would not be surprising if it were found the whole so taken.

As a class the Half Breeds would have been better had they received neither land nor scrip, it only demoralized them. The same agitation is, however, still going on, being fostered by scrip agents who prey on the ignorant and weak, and it seems unfortunate that our political leaders are unable to withstand the pressure brought to bear upon them in this regard.

TRANSFER OF LANDS.

It might also be well to direct attention to the fact that prior to the administration by the Dominion Government, lands were traded or bargained about as chattels are now done. A. sold to B. his lot, B. took possession, or it was the general knowledge in the country that A. had sold out to B., and nothing more was ever said about it. There was no more formality over titles than there is now when people dispose of any chattel.

In the early days an attempt to establish titles was made by the Council of Assiniboia. A system of transfer was adopted. A register was opened and kept at Fort Garry, in which when a man acquired a parcel of land from the Hudson's Bay Company, his name was supposed to be entered, and when he transferred it the transferor came together with the transferee and acknowledged before the official who had charge of said Register that he had transferred his lot and an entry to that effect was made in the Register. The foregoing was the theory. In practise, however, many people took possession of lands and their title was recognized whose name never appeared on the Register. Probably in most cases they never paid anything for their lots. These lots were originally sold for the nominal price of three pepper corns, and when transfers were made it was the exception rather than the rule that the transferor and the transferee entered the transfer in the Register. In the early days the theory was lived up to to a fair extent, but latterly no attention seems to have been paid to it. The result was that in the final settlement of title to these lots many disputes inevitably arose, particularly in cases where parties were not in possession. A Commission was appointed to take evidence in these disputes and make a recommendation in the case, and that recommendation was almost invariably followed and title issued.

This neglect of registration brought at times disastrous results. One instance where it resulted probably in greater disaster than in any other, was in the case of the estate of the late Hon. James McKay. There is no doubt whatever that if he had had his land matters in shape so that his executors could have found out what he really owned, the estate would have turned out handsomely. As it was it became insolvent in winding it up. That gentleman had a surprising memory, he did a large amount of trading, but unfortunately he kept all his transactions in his head, and accordingly when he died there were no records. A short time before his final illness he came to the undersigned and asked what he would charge to identify under the system of survey, the lands which he claimed. He knew where his various lots lay in reference to somebody else's lot, but he had no idea of the number, and in some cases did not know the parish. I stated what fee I would require for such purpose, but he thought that was too large, and appeared never to have obtained the services of anyone in this respect. Had He carried into effect the scheme he then suggested, in discussing it with me, it would have proved worth probably hundreds of thousands of dollars to his heirs.

As an item of very great interest, I would point to a joint address from the two Houses of the Legislature of the Province of

Manitoba which accompanied a despatch from the Lieutenant-Governor in February, 1872, in which the following appears:—

> "That the ridges and high lands of the Province hitherto reserved as places of refuge for the population, on occasions of inundation, be declared the inalienable property of the Dominion for that purpose."

It is probable there is not 1% of the present population of Manitoba to whom it has ever occurred how vital this matter seemed to the then residents of the Province. On two occasions, within a period of slightly over 20 years preceding the date of that memorial, a very large percentage, if not all of the population had to abandon their homes and take to these ridges. There is now, I think, no probability of a repetition of such things, as there is no doubt that a little action on the part of the people would have largely modified ,if not pervented those disasters. Precipitation in Manitoba is not so great that it cannot be absorbed by the soil if the surface is in such a condition that it can penetrate it. In the old days when the surface was a matt of frozen grass; a sudden thaw left the water on the surface and it accumulated and ran off in floods. To-day, a large percentage of that would go into the ground. In looking back at the past it might be pointed out that a very grave discussion was carried on for years prior to 1877, as to whether bridge piers could be built in the Red River at Winnipeg or below it, which would withstand the ice flow.

The members of that Legislature were as follows, with the constituencies represented by them:—

Baie St. Paul	Jos. Dubuc.
Headingly	John Taylor.
High Bluff	John Norquay.
Kildonan	John Sutherland.
Portage la Prairie	Frederick Bird.
Poplar Point	D. Spence.
Lake Manitoba	Angus McKay.
St. Agathe	George Klyne.
St. Anne	J. H. McTavish.
St. Andrews S	E. H. G. G. Hay.
St. Andrews N	Hon. Alfred Boyd.
St. Clements	Thos. Bunn.
St. Boniface W	Louis Schmidt.
St. Boniface E	Hon. M. A. Girard.
St. Charles	H. J. Clarke.
St. James	Edwin Bourke.
St. Fr. Xavier W	Jos. Royal.

St. Fr. Xavier E	Pascal Breland.
St. Norbert W	Jos. Lemay.
St. Norbert S	Pierre Delorme.
St. Pauls	Dr. C. J. Bird.
St. Peters	Thos. Howard.
St. Vital	A. Beauchemin.
Winnipeg	Donald A. Smith.

The Members of the Legislative Council were as follows:—

Hon. James McKay.
Hon. J. H. O'Donnell.
Hon. Colin Inkster.
Hon. Solomon Hamelin.
Hon. Francois Dauphinaie.
Hon. Francis Ogletree.
Hon. Donald Gunn.

Of the twenty-four members of the Legislature, fourteen were natives. Of the remaining ten, all but one had been many years in the country and the majority of them had probably experienced one of the two floods mentioned.

Of the Legislative Council, consisting of seven members, five were natives of the country, two were not, but one of them had experienced one if not both of the floods alluded to.

In the address above referred to the Government is requested to grant to the families of whites the same rights as granted to Half Breeds, so far as land and scrip is concerned. This, afterwards known as White Settlers' Scrip, was later provided for by Act of Parliamrnt. By Section 4, 37 Victoria, Chap. 20, assented to 26th May, 1874, provision was made for granting what is known as White Settlers' Scrip to those, or their descendants, who came into the country between 1813 and 1835. The clauses are as follows:—

"And whereas it is also expedient to recognize the claims to free grants of land on the part of certain original white settlers in the said Province, who settled in the country at an early date, but not under the auspices of Lord Selkirk, and to provide for the same by an issue of scrip, therefore:—

"Each and every person now resident in the said Province being original white settlers who came into the Red River country, whether under the auspices of Lord Selkirk or otherwise, between the years one thousand eight hundred and thirteen and one thousand eight hundred and thirty-five, both inclusive, or the children, not being half-breeds, of such original white settlers, shall be entitled under regulations to be made by the Governor-General in Council to receive scrip for one hundred and sixty dollars, the same to be receivable in payment for the purchase of Dominion Lands."

SURVEYS.

The Hudson's Bay Company's survey of river lots on the Red and Assiniboine Rivers was made by their surveyor, Taylor, in 1836-7-8. This was what was generally called the "Old Settlement Belt Survey.

The first regulations of the Dominion Government regarding surveys and settlement that can be found are those promulgated by Order in Council of the 1st March, 1871. It provides for the system of survey; provides that road allowances shall not be more than one chain in width around each section; and also provides for homestead and pre-emption rights.

These regulations were superseded by Order in Council of the 25th April of that year, which provided that the road allowances be 1½ chains in width. Both Orders in Council are at this date most interesting.

On the 11th May, 1871, an Order in Council was passed fixing the amount that should be paid for survey work. For base and correction lines it was to be $9.00 per mile. For township and section lines in sub-divisions, $7.00 per mile. To the surveyors that were to be engaged in surveying in the settled portions of the Province, that is, the river lot surveys, the following was to be the allowance:—

"That such surveying parties as may be employed in surveying the setteld portions of the Province be severally constituted and paid as follows:—

One Deputy Surveyor	$ 4.00	per	day.
Two chainmen, $1.00 each	2.00	"	"
Two axe or flag men	2.00	"	"
One cook	1.00	"	"
One horse and cart, in charge of cook	1.00	"	"
Allowance of 60 cents each per diem to Surveyor to cover cost of rations	3.60	"	"
Making daily cost of party	$13.60		

"That the surveyors in charge of parties engaged in surveying the settlements be allowed, in addition, a reasonable sum to cover cost of a couple of tents and for cooking utensils; everything else they and their men will provide for themselves.

"That an allowance to cover travelling expenses from Canada to Manitoba be made to the several surveyors selected for employment in the said Province this season, whether such employment may be under the contract system or otherwise."

These regulations were changed by Order in Council of the 1st March, 1872, and under it the pay of surveyors on settlement work and timber limits, etc., was raised to $5.00 per day and the actual cost of the hire of men provided.

"That the Surveyor receive five dollars per day as his own rate of pay.

"That he be allowed the actual cost of hire of men always, provided the number of his men is not in excess of what the character of the survey may require (of which this Department shall be sole judge), such cost to be exhibited in a pay list, to be submitted, sworn to by him, showing the date of engagements and discharge of every man, and his occupation and rate of daily pay, and such pay list to be also signed by the men as in full of all pay or claim for such service.

"That he be allowed for himself and for each man of his party, while occupied on such service, sixty cents per day, of a ration allowance, together with a reasonable charge for camping equipage, and for the transport of himself and party (if any cost of the last mentioned character should have been incurred) to and from his survey, and for the transport of camp equipage and supplies."

The rates of pay were as follows:—

Character of Work.	1st Class Open Prairie.	2nd Class Poplar Woods.	3rd Class. For other woods or heavy timber or wind-fall, or for dense bottom scrub with vines or thick willow or hazel.
1. Block Surveys.	$9 per mile. .	$15 per mile. .	$25 per mile.
2. Township Subdivision.	7 per mile. .	11 per mile. .	18 per mile.

"It being understood that for making the necessary measurements and placing the section and quarter-section corners on one side of the road allowance on a correction line, the other limit of such road allowance having been run and marked, the Surveyor shall be paid the uniform rate of eight dollars per mile."

This scale of rates appears to have been so low that the surveyors could not exist on it, at least so far as outline and subdivision work was concerned, and on the 22nd April, 1873, new regulations came into force which recited as follows:—

"On the recommendation of the Honourable the Secretary of State, and for the reasons given in his memorandum dated 17th April, 1873, suggesting certain modifications in the remuneration allowed to surveyors, employed in the Dominion Lands Survey in Manitoba and the North-West Territory, the Committee advise that the Order in Council of the 1st March, 1872, be amended; that the block outline surveyors be given daily pay; and that in order to obtain the most capable men for this work, their remuneration be fixed at an amount not to exceed six dollars per diem."

The memorandum referred to read as follows:—

"In connection with the prosecution of the Dominion Lands Surveys in Manitoba and the North-West Territories, the undersigned has had brought under his notice certain undesirable effects connected with the application of the contract system to the block outline surveys.

"These surveys govern and form the basis or ground work of the subsequent subdivision surveys into townships and lots; on them depend the uniformity of the laying out of the latter, and the accuracy with which are obtained and mapped the leading topographical features of the country surveyed. The Inspector clearly establishes, and he is sustained by the Surveyor-General in the view, that while the outline surveys might be made in a moderately clear country, not remote from centres of supply, at the prices fixed for these, the conditions of the outset of the surveys, as they reached great distances from provision depots, and the country offering obstacles to survey not contemplated or provided for in the schedule of rates, it became exceedingly difficult for the conscientious surveyor to carry on his work, feeling that if he exercised due care and took therewith all the pains necessary, his progress under these adverse circumstances would be so slow that, possibly, he would be barely able at contract rates to meet his daily expenses for his party, and might be entirely without remuneration for his own personal services.

"The effect on the surveys would be still more injurious when a less scrupulous surveyor found himself so situated. He would be tempted to guard against loss by hurrying through and slighting his work, and his resulting inaccuracies might not come to light until so much other work had been based on them that the errors entailed throughout would be irrevocable.

"It might appear that by allowing proportionately higher contract rates, any evils of the kind set forth would be avoided, but it would be imppossible to assign prices to meet the different grades of difficulties to be encountered in a comparatively unknown country; further even were these difficulties known, their varying shades and the vicissitudes of weather—an important matter where numerous astronomic observations are imperative—would entail an impracticably cumbersome multiplicity of rates.

"To assure the careful performance of these, the most important of the surveys, and to deal justly by the surveyors, the undersigned would recommend that the Order in Council of the 1st March, 1872, be amended: that the block outline surveyors be given daily pay, and that in order to obtain the most capable men for this work their remuneration be fixed at an amount not to exceed six dollars per diem.

"That for the expense of their parties in wages, supplies, transport, camp equipage, etc., they be paid as provided in the said Order in Council for the case of daily paid surveyors, as some of the best, most trustworthy and energetic of the outline surveyors failed during past seasons to make by their contracts more than enough to cover their expenses, with little or hardly any allowance for their own time and labor; the undersigned would further recommend that they be given the option of taking the remuneration fixed by the above Order in Council for the daily paid settlement surveyors employed at the same time, namely, five dollars per diem, and certain allowances for expenditure, or of being paid at the rates specified in their contracts should be given them."

It would appear that at this time the surveys for subdivision work and the surveys of parishes were left as provided for in the first Order in Council.

On the 12th May, 1875, these rates, so far as subdivision work is concerned, were again amended, and the rate of remuneration was based on its position, that is, its distance from certain fixed points. It is a long schedule and it is perhaps at the present time, not of sufficient interest to quote.

In 1871-2, surveys of the river lots from St. Agathe to St. Peter, and up the Assiniboine to Portage La Prairie, were made by Dominion Land Surveyors Beudry, D'Anteill, Doucet, Sinclair, McPhillips and McFadden. These were preliminary surveys for the purpose of locating the settlers' holdings and checking the river survey of the Hudson's Bay Company. Base lines were run through the settlements near the river, and the lots were numbered continuously from where the surveyor commenced the survey, to where he left off, whether on one or both sides of the river, and regardless of parish lines. Plans of these preliminary surveys were then prepared on a scale of ten (10) chains to the inch, and on them the depths of the lots, taken from the Hudson Bay Land Registry, were laid down, and a rear line adjusted. No rear line was established in the field by the Company's survey, only a base line at the rivers, from which surveyors afterwards gave the settlers' alignments, few lines were run far out from the river. It was found that the river in some places differed in position from the old survey, consequently the projected depths did not give a straight line in rear, so to avoid angles and not cut the lots short, some lots got a little more depth than they were entitled to by the Register.

The regular Parish surveys then followed, a uniform and continuous system of numbering was adopted, and the lots were posted along thê base lines and in rear.

The surveyors whose names appeared in connection with completed surveys of the parish river lot surveys are:—A. F. Martin, Moses McFadden, George McPhillips, Duncan Sinclair, A. H. Vaughan, Wm. Wagner. All have since passed over the great divide, except Moses McFadden.

There were also some others whose names I cannot now call to mind, who were engaged in the preliminary surveys of said parishes.

In 1874 the government decided to survey on the ground, the outer two miles of the river lots. The surveys of said outer two miles were made in that year as follows:—

St. Nobert, St. Boniface, by Martin.
St. Charles, St. Johns, Kildonan and St. Pauls West of River, by Harris.
St. Andrews and St. Clements West of River, by A. H. Vaughan.
St. Francois Xavier and Headingly, both sides of river, St. Johns, Kildonan, St. Pauls, St. Andrews, and St. Clements, on the east side of river, by Pearce.

The result of the surveys of that year was to demonstrate that in many places, particularly in St. Andrews on the west side of the river, there were a large number of what were known as "Park Claims." In the outer two miles of St. Andrews, particularly on the west side of the river, there were quite a lot of improvements and buildings, known as Buttertown. The centre of that lay immediately back of St. Andrews Rapids and extended some miles both up and down in the direction of Red River. There was better pasturage out there than there was along the River, owing to absence of brush, and it had been the custom of the people for many years to take their cattle out there for the summer to milk and make butter. That led to cultivation of certain plots, and in many cases these plots were of considerable area. If you will refer to the map of the outer two miles of St. Andrews, some of them you will find were upwards of 60 acres in area. Many of them, however, were of very small area, two to eight acres. A few of these happened to fall in the outer two miles of the lot which the occupier owned on the river. Owing to the grasshopper visitation in Manitoba in 1872, 73, 74 and 75, the cultivation here was wholly abandoned, and in many cases fences had rotted, or been removed for firewood, and the houses themselves were not many in number or valuable in size, and no great injustice would have been done had those claims been wiped off the slate, but it is human nature to make as vigorous a fight for a small thing at issue as for a large one, and there is no doubt that to many of those settlers the amount at issue was large, although to many of us it would appear very trivial.

There is one point of interest which might be mentioned here, and that is, that as the result of a triangulation extending from Winnipeg to the neighborhood of Fort Ellice, made in 1874 and 1875, by what was first known as the Peace River Survey, and later known as the Special Survey, it was found that the surveys then established which were established out as far as Fort Ellice, over-ran about 14 links to the mile on the whole. The azimuths of the lines established as block outlines were excellent. The work was done by as careful men as are doing work today, among others the late John McLatchie, than whom no one in Canada ever did more accurate work for ordinary surveying. This excess in distance was largely, if not wholly, the outcome of the link chain then in use. The introduction of the band chain, which came into use, I think, about 1878 or 1879, introduced an element in chainage which led to much greater accuracy, and since that with ordinary care it is wonderful how close chainages have come out when checked by astronomical observations for either latitude or longitude.

The undersigned found in tying on the outer two miles to the parishes as they were then established, that he had great difficulty in making closings. In the first place he found that the chainage along the two mile line was frequently very much in error. The bearings also. His instructions were to produce the boundaries of each parish out to the exterior of the outer two mile belt, the rear line of the outer two miles being a boundary of legal subdivisions of sections or aliquot parts thereof. In running across a section defining those boundaries, it was found they were far from being theoretical. That is, if defined as the Act required the jogs on the ground differ considerably from 20 chains, but his instructions were to make them 20 chains, and to provide for the excess or deficiency by enlarging or contracting the angles, so that while the distances are theoretically correct, the angles are far from such. However, as this was approved by the authorities of the day it has to stand, and as no titles adjacent to this line were issued prior to the approval of this survey and the township maps amended in conformity therewith, the question of the manner in which this boundary was established never arose, and it would now be impossible for any contention of error in such definition of boundary to be sustained.

The first season that I was engaged on the work, the party consisted of one horse and cart, two chainmen, a picket man, and cook. Speaking from memory, I think the wages paid that year, 1874, were:—

1st chainman	$1.50	per day.
2nd chainman	1.25	" "
Cook and other man	1.00	" "

An allowance of sixty cents per day for rations, and $1.00 per day for horse and cart. An allowance for the furnishing of tent, cooking outfit, etc., was given. Each man supplied his own blankets.

In 1876 it was necessary to make a final survey of the outer two miles as the width of road allowances had been changed from 1 chain to 1½ chains, and also establish the park claims.

The increased width of the road allowances and establishment of those connecting the 2 and 4 miles road allowances was authorized by sub-sections 2, 3, and 4, of Section 4 of 39 Vic. Chap. 20, approved 12th April, 1876.

Said clauses are as follows:—

"2. A road one chain and fifty links wide in the rear of the lots contained in the "Outer Two Miles" or "Hay Privilege," beforementioned, and between them and the sections, or legal subdivisions thereof, bounding the same, except in cases where the said rear boundary of the said lots may prove to be a regular section line in the township survey;

"3. Roads, each one chain in width, at convenient distances, say every two miles or thereabouts, between lots in the said "Outer Two Miles," and running from the front to the rear thereof:

"4. The roads provided for in the next preceding sub-section shall be laid out between such lots as the Minister of the Interior shall indicate with that view, and shall be taken half off each of such lots or the whole width off one of such lots in the discretion of the said Minister; and the persons to whom it is proposed to grant such lots may be compensated by the said Minister for the quantity of land respectively contributed by them to any such road, by the issue of land scrip to them at the rate of one dollar and fifty cents for each acre of land so contributed."

The undersigned that year made the final survey of the Outer Two Miles of Headingly and St. Francois Xavier on both sides of the River, St. Andrews and St. Clements on both sides of the river, St. Pauls, Kildonan and St. Johns, on the east side of the river; St. Charles, south of river; St. Norbert, and St. Boniface, both sides of the River. J. W. Harris established the surveys of St. Charles, St. James, St. Johns, Kildonan and St. Pauls, on the north side of the Assiniboine and the wast side of the Red Rivers. In 1876 the undersigned enlarged his party. He had two horses and carts, and two more men.

It might be mentioned in passing that the year 1874 was the worst year for thunder and lightning that the writer ever experienced. Some of the electrical storms were really terrifying. They were perhaps particularly so to him, not having been to a very considerable extent accustomed to prairie under such conditions. The area covered by the electrical display was so large that it appeared much more grand and extensive, even terrifying, than it would appear today, but after making due allowance for that he has no doubt that the statement that they were worse than any storms the country has seen since that date, is correct. There was very considerable loss of life and stock, and when you consider the sparcity of the population, such a condition of affairs today would be astonishing if not alarming in its results.

There is one matter in connection with river lots that perhaps many are not aware of, and that is, that a considerable portion of the lots on the east side of the Red River in the parishes of St.

Andrews, St. Pauls, and Kildonan, were granted to the owners of the lots on the opposite side as wood lots, and up to the time of my survey in 1876, in St. Andrews, a considerable percentage of the people living on the east side of the river were merely squatters thereon, the owners of the lots living on the opposite bank. In the Outer Two Miles of those lots on the east side of the river, there were considerable hay lands and on the west side of the river very little hay land, and the result was that a considerable portion of the people in St. Andrews owned lots on both sides of the river, these holdings, although not extensive in area were great in length. The same remarks applied to some extent to St. Pauls and Kildonan. Kildonan was originally settled on the west side of the river and the opposite bank held for wood lots. Each lot had been fairly well settled on, but cultivation, however, was towards the rear of the lots, immediately along the river being fairly well timbered. This right to wood lots also was allotted in some cases in Ste. Agathe. Where the west side of the River was bare prairie the then settlers claimed that, under the Manitoba Act, the lands on the opposite bank, which were timbered, belonged as wood lots to those on the west bank, and their contention was, after a prolonged contention in many cases, acceded to. Of course it must be borne in mind that every Manitoba Act claimant obtained $1.00 in scrip for every acre of land granted, but where the Outer Two Miles or wood lot was allotted, such $1.00 was not granted. That $1.00 in scrip was supposed to represent an acre of land which the settler could locate elsewhere, and was granted in commutation of all his hay and common right.

There is no doubt that the Dominion Government was extremely liberal, in fact prodigal, in dealing with those claims. That the claimants did not profit was of course their own fault. It was unfortunate, but would appear to have been inevitable. Some of the leaders of thought like Archbishop Tache had requested that the Government act as trustees for these people and hold the lands for them. That would have worked out well for the individual, but it is not in conformity with the genius of our institutions, or was not at that time, but the grownig agitation and sentiment towards governmental control of everything might now, or at all events, in the near future, sanction the adoption of such a course. It probably may be unfortunate for the country, if the time ever arrives when such doctrine becomes generally prevalent.

SURVEYORS' SUPPLIES.

In 1872, and probably in 1873, the Governemnt, to aid the surveyors, brought in a very considerable amount of provisions in the way of bacon, canned vegetables for soup purposes, and biscuits. The bacon was brought from Chicago, canned vetegables were of French manufacture, and the biscuits were made in Collingwood and had a slight mixture of rice in them. In 1874 the Government still had on hand a considerable amount of biscuits and vegetables. Mr. Harry Powell, later of the Customs Department in Winnipeg, and whom many of you probably know, had charge of the storehouse and was of much assistance to new-comers like myself, in obtaining men and transportation. At that time, and for some years subsequent, surveyors did not have the variety of diet that they now think necessary. In one exploring expedition undertaken by the undersigned, the only supplies he had were tea, hard tack, pemican and some lard to be used when he could obtain fish fit for roasting before the fire. It was the winter season and the fish were what were known as hung fish, that is, frozen. He was buying them in considerable quantities for his dogs. The lowest rate that he ever reached in feeding men was 40c. per day, but if one had not an economical cook it would run a good deal higher than that. During the latter half of the season, with a small party and a cook who was fond of shooting and a fair marksman, one could keep the larder well filled with meat in the way of prairie chicken and ducks.

During the survey of the Outer Two Miles made by me in 1874, the hay swamps were full to the brim and many times it was a case of wading for days from your knee to your waist, and sometimes to a greater depth. Particularly was this the case at Headingly and St. Francois Xavier on the south side of the river. Of course there was an occasional ridge where one could get dry. He well remembers the fact that he was persuaded to utilize linen overalls. On account of so much wading in water, no underwear was used. After wading in water several times the mesh of the linen became so open that the bulldog and other pests could get in their working end without any obstacle whatever, and when they did so the party on whom they operated became acutely aware of it most promptly.

LIST OF PARISHES IN MANITOBA, GIVING AREAS.

Parish.	Acres.	Final Surveys.
St. Peter	16123.80	A. H. Vaughan, 1874 & 5.
St. Andrew	18992.27	A. H. Vaughan, 1873-75.
St. Clements	10187.19	A. H. Vaughan, 1873-75.
St. Pauls	12858.65	Duncan Sinclair, 1873.
Kildonan	9843.00	Duncan Sinclair, 1873.

St. John	3343.40	Duncan Sinclair, 1873.
St. James	6851.26	and
St. Boniface	8925.35	Geo. McPhillips, sr., 1874
St. Viral	5504.63	Geo. McPhiilips, Sr., 1874.
St. Norbert	31917.39	Geo. McPhillips, Sr., 1874.
Grand Pointe (in rear of St. Norbert E.)	926.70	M. J. Charbouneau, 1884.
St. Agathe	89300.39	Jos. Doupe, McPhillips & Martin, 1874.
St. Charles	12127.20	McPhillips & Sinclair, 1874.
Headingley	11336.35	McPhillips & Sinclair, 1874.
St. Francois Xavier	26173.21	McPhillips 1873.
Baie St. Paul	31961.82	McPhillips, M. McFadden & Wagner, 1873-4.
Poplar Point	16245.60	McFadden&Wagner 1873-4
High Bluff	15057.17	" " "
Portage la Prairie	27305.04	McFadden, Wagner & McPhillips, 1873-4.
Westbourne	4825.29	Wagner, 1874.
Lorette (not "Loretto" This P. O. name and a mistake)	18707.32	McPhillips, 1878
Oak Island	2394.00	F. L. Foster, 1883.
Ste. Anne	16097.39	McPhillips, 1872 & 4.
St. Malo (on Rat River)	5376.93	W. J. Charbouneau, 1884.
St. Laurent (L. Manitoba	4513.50	Wagner, 1874.
Oak Point (L. Manitoba)	2698.80	Wagner. 1874.
Rat River	12450.00	F. L. Foster, 1883.
Manitoba House	4342.10	A. H. Macdougall, 1887.
Fort Alexander	2624.75	R. C. McPhillips, 1891.
Fairford	1862.00	A. F. Martin, 1877.

This is a list of the old settlements in Manitoba and includes all the parishes.

The areas given are for the settlement proper, exclusive of the lots in the "Outer Two Miles." The area of the Saint Francois Xavier Parish was calculated and was found to be the same as given on this list. Evidently the area of the "Outer Two Miles" of these Parishes has never been totaled.

This is from a register in the Surveyor-General's office. It was impossible, without much delay, to get the areas separated for both sides of the rivers, Assiniboine and Red Rivers.

The parishes included in the old "Settlement Belt" or Hudson's Bay Company's survey extended from St. Norbert (inclusive) to about half way through St. Clements on the Red River and up the Assiniboine to (and including) St. Francois Xavier. These are the parishes which had "Outer-two-miles" and practically extended over the "Outer-two-mile" area." See lists with areas, etc.

The lots in the old H. B. survey were mostly six (6) chains wide, but there were many of only 3 chains. Our surveyors found some a little over and some less. The Parish lots comprise one or more of the old ones. There were a few very wide lots in the old survey for H. B. Posts and Church lands. The lots were sold at 5– and 7—6 an acre, mostly at the lower price. Where regular sale entries were made in the register they were usually half "gratis" and half "payable" and to a great extent have remained "payable". There were also many entries of names without any charge against them. The Company did not make a fortune out of those lands.

OUTER-TWO-MILES.

Parish.	Acres. approx.	
St. Norbert (E)	7040	A. F. Martin, 1874.
St. Norbert (W)	7360	A. F. Martin, 1874.
St. Vital	2880	A. F. Martin, 1874.
St. Boniface (E)	1600	A. F. Martin, 1874.
St. Boniface (W)	650	Wm. Pearce, 1876.
St. John	2240	J. W. Harris, 1877.
Kildonan (E)	3200	Wm. Pearce, 1876.
Kildonan (W)	4800	J. W. Harris, 1875.
St. Paul (E)	4800	Wm. Pearce, 1876.
St. Paul (W)	6400	J. W. Harris, 1875.
St. Andrews (E)	9280	Wm. Pearce, 1876-7.
St. Andrews (W)	8300	
St. Clements (E)	4450	Wm. Pearce, 1876-7.
St. Clements (W)	3800	
St. James	5120	J. W. Harris, 1877.
St. Charles (N)	2880	A. F. Martin, 1874.
St. Charles (S)	8300	and J. W. Harris, 1877.
Headingly (N)	5100	Wm. Pearce, 1874.
Headingley (S)	5100	
St. Francois Xavier (N)	12800	Wm. Pearce, 1877.
St. Francois Xavier (S)	12800	Wm. Pearce, 1874.

Re Order in Council 18th April, 1874, I do not know why St. Clements was omitted and the old fyles are not easy to find. The lots, from where the H. B. survey ended—about half through the parish—were extended to put the parish in better shape. The St. Peter Reserve line made an acute angle with the "2 mile" line on the west side and obtuse on the east. Had the township surveys "butted in" to the "2 mile" line there would have been an awkward lot of broken sections.

No Order in Council or special authority was required as the Government could deal with the lands as it pleased outside of the H. B. Survey and claims under the "Manitoba Act."

LIST OF MEMBERS.

HONORARY MEMBERS.

Hon. Patron:

Deville, E., LL.D., D.T.S., Surveyor-General, Interior Dept., Ottawa.

Hon. President:

King, W. F., C.M.G., LL.D., D.T.S., Chief Astronomer, Interior Dept., Ottawa.

Hon. Members:

Casgrain, Hon. J. P. B., D.L.S., Senator, The Senate ,Ottawa.
Magrath, C. A., D.T.S., International Waterways Commission, Ottawa.
Dennis, J. S., D.T.S., Commissioner of National Resources for C.P.R., Montreal.
Klotz, Otto, D.Sc., D.T.S., Assistant Chief Astronomer, Interior Dept., Ottawa.
Stewart, W. J., Chief Hydrographer, Marine Dept., Ottawa.
Campbell, R. H., Director of Forestry, Interior Dept., Ottawa.
Symes, P. B., Cor. Lyon & Somerset Sts., Ottawa.

Past Presidents:

Hubbell, E. W., D.L.S., 1907-08.
Young, R. E., D.L.S., 1909-1910.
Fawcett, Thos., D.L.S., 1911.
Belanger, P. R. A., 1912.
Miles, C. F., D.L.S., 1913.

Date of Election.

LIST OF ACTIVE MEMBERS.

1912—Akins, J. R., D.L.S., Dunvegan, Alta.
1907—Aylen, J., D.L.S., North Bay, Ont.
1907—Aylsworth, C. F., Jr., D.L.S., Madoc, Ont., President.

1913—Baird, W. J., D.L.S., Scarboro P. O., Ont.
1910—Barber, H. G., D.L.S., Interior Dept., Ottawa.
1907—Bayne, G. A., D.L.S., c/o Hudson's Bay Company, Winnipeg.
1907—Beatty, D., D.L.S., Parry Sound, Ont.
1912—Bennett, G. A., D.L.S., Eden, Ont.
1913—Berasford, H. E., Portage la Prairie, Man.
1912—Berry, E. W., D.L.S., The Rectory, Seaforth, Ont.
1910—Bigger, C. A., D.L.S., Geodetic Survey, Ottawa.
1909—Bingham, E. R., D.L.S., 418 Victoria Ave., Fort William, Ont.
1911—Blanchet, G. H., D.L.S., 321 James St., Ottawa, Ont.
1914—Bobeau, L. M., Nelson, B. C.
1913—Boulton, W. J., D.L.S., Mattawa, Ont.
1907—Bourgault, C. E., D.L.S., St. Jean Port Joli, P.Q.
1910—Bourgeault, A., D.L.S, St. Jean Port Joli, P.Q.
1912—Bowman, E. P., D.L.S., West Montrose, Ont.
1907—Brabazon, A. J., D.L.S., Interior Dept., Ottawa.
1909—Brady, Jas., D.L.S., Golden, B.C.
1907—Bray, L. T., D.L.S., Edmonton, Alta.
1910—Bray, S., D.L.S., Indian Dept., Ottawa, Chief Surveyor.
1910—Brenot, L., D.L.S., Fort St. John, B.C.
1910—Bridgland, M.P., D.L.S., Box 257, Calgary, Alta.

Date of
Election.

ACTIVE MEMBERS—Continued.

1912—Brownlee, J. H., D.L.S., 325 Homer St.. Vanvouver, B.C.
1913—Buchanan, T., D.L.S., 140 Jasper Ave., Edmonton, Alta.
1907—Burgess, E. L., D.L.S., Victoria, B.C.
1912—Brown, Thos. W., Box 438, Saskatoon, Sask.

1912—Calder, J. A., D.L.S., Ashcroft, B.C.
1913—Cannell, H. W., D.L.S., Dept. Interior, Ottawa.
1911—Campbell, A. S., D.L.S., Cor. King and Brock Sts., Kingston, Ont.
1913—Carthew, J. T., D.L.S., Edmonton, Alta.
1909—Cautley, R. W., D.L.S., 523 Sixth St., Edmonton, Alta.
1912—Chase, A. V., D.L.S., Orillia, Ont.
1913—Christie, U. W., D.L.S., Interior Dept., Ottawa.
1910—Christie, Wm., D.L.S., Box 74, Prince Albert, Sask.
1912—Clements, F. S., D.L.S., Box 49, Prince Rupert, B.C.
1909—Cleveland, E. A., D.L.S., Flack Block, Vancouver, B.C.
1910—Clunn, T. H. G., D.L.S., Interior Dept., Ottawa.
1909—Cochrane, M. .F, D.L.S., Interior Dept., Ottawa.
1913—Coltham, Geo. W., D.L.S., Box 264, Aurora, Ont.
1907—Coté, J. L., D.L.S., Edmonton, Alta.
1913—Coté, P. M., Ottawa, Ont.
1910—Cotton, A. F., D.L.S., New Westminster, B.C.
1912—Cowper, G. C., D.L.S., Welland, Ont.
1909—Craig, J. D., D.L.S., Interior Dept., Ottawa.
1913—Cummings, A. F., D.L.S., Fernie, B.C.
1910—Cumming, A. L., D.L.S., Hotel Cecil, Edmonton, Alta.
1907—Currie, P. W., D.L.S., Interior Dept., Ottawa.

1911—Davies, T. A., D.L.S., 52 McDougal Ave., Edmonton, Alta.
1911—Day, H. S., D.L.S., Marchand Apartments, Edmonton, Alta.
1908—Deans, W. J., D.L.S., Inspector of Surveys, Brandon, Man.
1912—de la Condamine, C., D.L.S., Box 1774, Calgary, Alta.
1911—Dennis, E. M., D.L.S., Interior Dept., Ottawa.
1912—Dennis, M., D.L.S., Interior Dept., Ottawa.
1907—*Dickson, H. G., D.L.S., Whitehorse, Yukon.
1912—Dillabough, J. U., D.L.S., c o Chief Engineer, H. B. C., Winnipeg, Man.
1909—Dodge, G. B., D.L.S., Interior Dept., Ottawa,
1913—Donnelly, Cecil, D.L.S., 343 Carlton St., Winnipeg, Man.
1907—Doupe, J. L., D.L.S., c o C.P.R., Land Department, Winnipeg.
1913—Dozois, L. O. R., Box 1774, Calgary, Alta.
1910—Drummond, T., D.T.S., 119 St. Matthew St., Montreal.
1909—Ducker, W. A., D.L.S., 144 Smith St., Winnipeg.
1907—Dumais, P. T. C., D.L.S., Hull, P.Q.

1911—Earle, W. S., D.L.S., Picton, Ont.
1913—Edeskoly, Von J., D.L.S., 17 Inns. of Court Bldg., Vancouver, B.C
1909—Edwards, Geo., D.L.S., Ponoka, Alta.
1913—Edwards, W. M., University of Alberta, Edmonton.
1913—Elliott, G. R., Calgary, Alta.
1907—Engler, C., D.L.S., Interior Dept., Ottawa.
1912—Evans, S. L., D.L.S., Corinth, Ont.

1910—Fairchild, C. C., D.L.S., 54 Brant Ave., Brantford, Ont.
1907—Fawcett, A., D.L.S., Gravenhurst, Ont.
1907—Fawcett, Thos., D.T.S., Boundary Surveys, Ottawa.

Date of
Election.

ACTIVE MEMBERS.—Continued.

1910—Ferguson, G. H., D.L.S., Commission of Conservation, Ottawa.
1911—Fletcher, J. A., D.L.S., Interior Dept., Ottawa.
1907—Fontaine, L. E., D.L.S., Inspector of Surveys. Levis, P.Q.
1913—Francis, J., Portage la Prairie, Man.

1911—Galletly, J. S., D.L.S., Peace River Crossing, Alta.
1909—Garner, A. C., D.L.S., 2133 Cameron St., Regina, Sask.
1908—Gibbon, Jas., D.L.S., 1386 11th Ave. West, Vancouver, B.C.
1913—Glover, A. E., D.L.S., 140 Jasper Ave. West, Edmonton, Alta.
1913—Grassie, G., Medicine Hat, Alta.
1913—Griffith, A. D., D.L.S., 104 Walnut Ave., Winnipeg.
1907—Grover, G. A., D.L.S., 24 King St. West, Toronto.
1910—Gordon, M. L., D.L.S., 619 Hastings St., Victoria, B.C.

1913—Hamilton, Chas. T., D.L.S., 1001 Rogers Bldg., Vancouver, B.C.
1911—Haggen, R. W., D.L.S., Revelstoke, B.C.
1913—Harris, J. W., D.L.S., City Engineer, Winnipeg, Man.
1910—Harvey, Chas., D.L.S., Kelowna, B.C.
1907—Hawkins, A. H., D.L.S., Listowel, Ont.
1907—Heathcott, R. V., D.L.S., Edmonton, Alta.
1913—Hemperman, L. F., D.L.S., Phoenix, Ariz., U.S.A.
1907—Henderson, F. D., D.L.S., Interior Dept., Ottawa.
1911—Herriot, G. H., D.L.S., Souris, Man.
1911—Higgins, C. J., D.L.S., Box 986, Vancouver, B.C.
1912—Hobbs, W. E., D.L.S., Winnipeg, Man.
1907—Holcroft, H. S., D.L.S., 105 St. Vincent St., Toronto.
1907—Hopkins, M. W., D.L.S., Edmonton, Alta.
1907—Hubbell, E. W., D.L.S., Secretary, Chief Inspector of Surveys, Dept. of the Interior, Ottawa.
1912—Hunter, A. E., D.L.S., Wiarton, Ont.

1911—Inkster, O., D.L.S., Edmonton, Alta.

1909—Jephson, R. J., D.L.S., Box 986, Brandon, Man.
1913—Johnston, R. H., 205 Fern Ave., Toronto.
1911—Johnston, W. J., D.L.S., 73 Exchange Building, 142 Hastings Street, Vancouver, B.C.
1912—Johnston, J. H., D.L.S., Peace River Crossing, Alta.
1912—Jones, G. S., D.L.S., Interior Department, Ottawa.

1907—Kirk, J. A., D.L.S., Summerland, B.C.
1911—Kitto, F. H., D.L.S., Director of Surveys, Dawson, Yukon.

1912—Latimer, F. H., D.L.S., Pentington, B.C.
1913—LeBlanc, P. M. H., Ottawa, Ont.
1910—Lemoine, C. E., D.L.S., 111 Mountain Hill, Quebec, P.Q.
1911—Lighthall, A., D.L.S., 2328 Vine St., Vancouver, B.C.
1907—Lonergan, G. J., D.L.S., Inspector of Surveys, Buckingham, P.Q.
1912—Loucks, R. W. E., D.L.S., Delisle, Sask.
1907—Lumsden, H. D., D.L.S., 152 Argyle Ave., Ottawa.

1912—Martindale, E. S., D.L.S., Kings Mill, Ont.
1912—Martyn, O. W., D.L.S., Box 443, Swift Current, Sask.
1911—Matheson, H., D.L.S., Pocahontas, Alta.
1914—Morency, Geo., D.L.S., Levis, P.Q.
1914—Moran, P. J., 950 Jarvis St., Vancouver, B.C.

Date of
Election.

ACTIVE MEMBERS—Continued.

1909—McArthur, J. J., D.L.S., Boundary Surveys, Ottawa.
1912—McCaw, R. D., D.L.S., Sindey, Vancouver Island, B.C.
1912—McEwen, D. F., D.L.S., Grouard, Alta.
1910—McFadden, M., D.L.S., 1255 15th Ave. E., Vancouver, B.C.
1910—McFarlane, J. B., D.L.S., 60 Lonsdale Road, Toronto.
1908—McGrandle, H., D.L.S., Wetaskiwin, Alta.
1912—McKay, R. B., D.L.S., 1146 Pacific St., Vancouver, B.C.
1914—McKnight, J. H., D.L.S., Simcoe, Ont.
1913—McNaughton, A. L., D.L.S., Cornwall, Ont.
1913—McElhanney, W. G., D.L.S., Vancouver, B.C.
1907—McMillan, Geo., D.L.S., Finch, Ont.
1912—Melhuish, P., D.L.S., 2328 Vine St., Vancouver, B.C.
1913—Milliken, J. B., D.L.S., Dept. Interior, Ottawa.
1907—Miles, C. F., D.L.S., Inspector of Surveys, 25 Marmaduke St., Toronto.
1909—Moberly, H. K., D.L.S., Moosomin, Sask.
1909—Montgomery, R. H., D.L.S., Prince Albert, Sask.
1909—Morrier, J. E., D.L.S., Prince Albert, Sask.
1907—Mountain, G. A., D.L.S., Chief Engineer to the Railway Commission, Ottawa.

1911—Narraway, A. M., D.L.S., 197 Second Ave., Ottawa.
1912—Neelands, R., D.L.S., Hamiota, Man.
1909—Nelles, D. H., D.L.S., Boundary Surveys, Ottawa.
1912—Neville, E. A., D.L.S., 936 Granville St., Vanvcouver, B.C.

1910—Ogilvie, N. J., D.L.S., Boundary Surveys, Ottawa.

1913—Parry, H., D.L.S., Interior Dept., Ottawa.
1912—Palmer, P. E., D.L.S., Dorchester, N.B.
1910—Parsons, J. L. R., D.L.S., Box 1004, Regina, Sask.
1910—Patrick, A. P., D.T.S., Calgary, Alta.
1910—Pearce, Wm., D.L.S., Calgary, Alta.
1913—Pearson, H. E., D.L.S., Box 1077, Edmonton, Alta.
1913—Peters, F. N., D.L.S., P. O. Box 5, Calgary, Alta.
1907—Phillips, E. H., D.L.S., Saskatoon, Sask.
1911—Pierce, J. W., D.L.S., Room 43, Citizen Building, Ottawa.
1914—Pinder, G. Z., D.L.S., Credit Foncier Bldg., Edmonton, Alta.
1911—Plunkett, T. H., D.L.S., Whitehorn, Man.
1912—Powell, W. H., D.L.S., 420 Michigan St., Victoria, B.C.
1912—Ponton, A. W., D.L.S., Edmonton, Alta.
1911—Purser, R. C., D.L.S., 32 Glengarry Ave., Windsor, Ont.

1911—Rainboth, G. L., D.L.S., 186 Cooper St., Ottawa.
1911—Ransom, J. T., D.L.S., 470 Manning Ave., Toronto.
1911—Reid, F. B., D.L.S., Geodetic Surveys, Ottawa.
1913—Reid, John, D.L.S., 161 Leonore St., Winnipeg, Man.
1907—Reilly, W. R., D.L.S., Regina, Sask.
1911—Rinfret, C., D.L.S., 26 Rue St. Jacques, Montreal.
1913—Robertson, D. F., D.L.S., Indian Affairs Dept., Ottawa.
1910—Robinson, E. W., D.L.S., Le Pas, Man.
1909—Rolfson, O., D.L.S., Box 378, Walkerville, Ont.
1907—Ross, Geo., D.L.S., Welland, Ont.
1910—Ross, J. E., D.L.S., Kamloops, B.C.
1907—Roy, G. P., D.L.S., 28 Lachevrotie, St., Quebec.
1911—Roy, J. E., D.L.S., 28 Lachevrotie St., Quebec.

Date of
Election.

ACTIVE MEMBERS.—Continued.

1908—Saint-Cyr, A., D.L.S., Box 1030, Prince Albert, Sask.
1907—Saint-Cyr, J. B., D.L.S., 1760 St. Urbian St., Montreal.
1909—Saunders, B. J., D.L.S., Edmonton, Alta.
1910—Scott, W. A., D.L.S., Saskatoon, Sask.
1909—Seager, E., D.L.S., Kenora, Ont.
1912—Segre, B. H., D.L.S., Toronto, Ont.
1912—Seibert, F. V., D.L.S., 609 Spadina Ave., Toronto.
1910—Seymour, H. L., D.L.S., Red Deer, Alta.
1907—Shanks, T., D.L.S., Asst. Surveyor General, Topographical Surveys Branch.
1912—Sheppard, H. C. T., D.L.S., Geological Survey, Ottawa.
1910—Shaw, C. A. E., D.L.S., Greenwood, B.C.
1912—Sirois, J. E., D.L.S., Box 26, Ste. Anne de la Pocatiere, Kamourasks, P.Q.
1908—Smith, C. C., D.L.S., Victoria, B.C.
1907—Speight, T. B., D.L.S., 703 Temple Building, Toronto.
1912—Soars, H. M. R., D.L.S., 637 First St., Edmonton, Alta.
1909—Steele, I. J., D.L.S., 18 Rideau Terrace, Rockliffe, Ottawa.
1912—Stewart, A. G., D.L.S., Hotel Cecil, Edmonton, Alta..
1912—Stewart, N. C., D.L.S., 936 Granville St., Vancouver, B.C.
1911—Stewart, W. M., D.L.S., Saskatoon, Sask.
1911—Stitt, O. M., D.L.S., 319 Pender St. W., Vancouver, B.C.
1913—Stock, J. J., D.L.S., Ottawa, Ont.
1911—Stuart, A. G., D.L.S., 150 Elgin St., Ottawa.
1911—Street, P. B., D.L.S., 17 Spadina Road, Toronto.

1914—Taylor, W. E., 323 Glen Road, Toronto.
1911—Taggart, C. H., D.L.S., 25 Patterson Ave., Ottawa.
1908—Teasdale, C. M., D.L.S., Concord, Ont.
1913—Tipper, G. A., D.L.S., 196 Marlborough Ave., Brantford, Ont.
1912—Tremblay, A. J., D.L.S., Box 1077, Edmonton, Alta.
1907—Tyrrell, J. W., D.L.S., 7 Hughson St., Hamilton, Ont.
1912—Tobey, W. M., D.T.S., Ottawa, Ont.

1911—Underwood, J. E., D.L.S., Saskatoon, Sask.

1913—Von Skiver, L. A., D.L.S., Fish Lake, Ont.

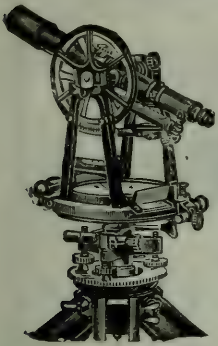
1913—Waddell, W. H., D.L.S., Edmonton, Alta.
1911—Walker, C. M., D.L.S., 24 Edward St., London, Ont.
1911—Wallace, J. N., D.L.S., Box 1774, Calgary, Alta.
1913—Waugh, B. W., D.L.S., Interior Dept., Ottawa.
1907—Weeks, A. S., D.L.S., 540 Sutherland St., Edmonton, Alta.
1910—Westland, C. R., D.L.S., Boundary Surveys, Ottawa.
1912—Whitcher, A. H., D.L.S., Secretary, Geographic Board, Ottawa.
1912—White, W. R., D.L.S., Indian Affairs Dept., Ottawa.
1912—Whyte, H. E., D.L.S., 620 North Park St., Victoria, B.C.
1912—Wright, A. E., D.L.S., Box 70, Prince Rupert, B.C.

DECEASED MEMBERS.

Joined the Association.	Name.	Date of Death.
1907	Reid, J. L., D.L.S	June 18th, 1911.
1907	Selby, H. W., D.L.S	August 23rd, 1910.
1907	Stacey, A. G., D.L.S	June 4th, 1908.
1907	Young, R. E., D.L.S	October 24th, 1911.
1908	Green, W. T., D.L.S	November 1st, 1909.

DECEASED MEMBERS.—*Continued.*

Joined the Association.	Name.	Date of Death.
1908	Ratz, W. F., D.L.S	February 6th, 1909.
1909	McLean, J. K., D.L.S	May 25th, 1913.
1909	Rainboth, G. C., D.L.S	November 2nd, 1910.
1910	Mackie, F. H., D.L.S	December 23rd, 1912.
1912	Ogilvie, Wm., D.L.S	November 13th, 1912.
1913	Johnson, C. E., D.L.S	December 31st, 1913.



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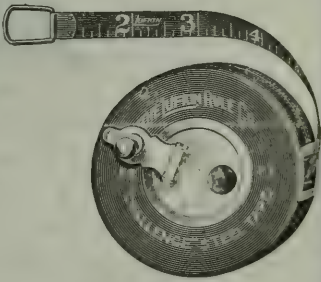

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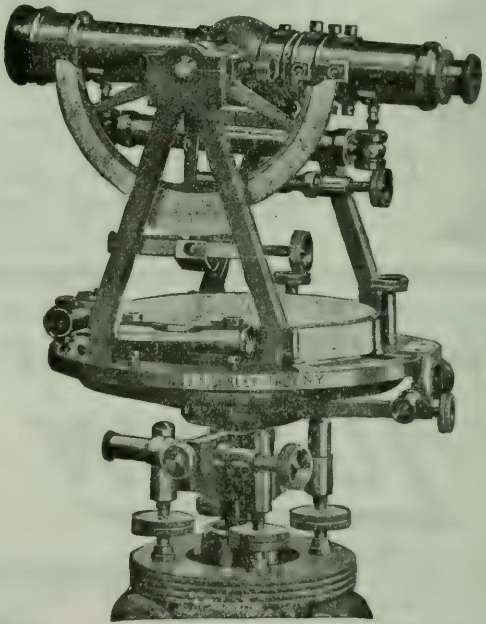

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ANNUAL REPORT

OF THE

Association of Dominion Land Surveyors

Ninth Annual Meeting

HELD AT

OTTAWA

ON THE 27th AND 28th OF JANUARY, 1915.

OTTAWA:
R. J. TAYLOR, PRINTER, QUEEN STREET.

1915

W. F. KING, C.M.G., LL.D., D.T.S.
HON. PRESIDENT

W. F. KING, C.M.G:, LLD., D.T.S.

KING, WILLIAM FREDERICK, (Dominion Public Service). Son William and Ellen (Archer) King, born Stowmarket, Suffolk, England, February 19th, 1854; came to Canada with his parents 1862; educated Port Hope Grammar School and Toronto University, (B.A. with gold medal in mathematics, 1875; LL.D., 1904); married December, 1881, Augusta Florence, daughter of late J. A. Snow, Ottawa. D.L.S. and D.T.S., 1876; began his first scientific work as computor and sub-asst. astronomer on the International Boundary Commission (Lake of the Woods to the Rocky Mountains) 1872; later was employed for some years on Dominion Lands Surveys in various parts of the North West Territories; entered permanent Civil Service, June 13, 1881, as Inspector of Surveys, promoted Chief Inspector, July, 1886, and became Chief Astronomer of the Department, with rank of Chief Clerk, July 1, 1890; has been Superintendent, Geodetic Survey of Canada since its establishment, 1909; has also been the Director of the Dominion Astronomical Observatory, Ottawa, since its opening, 1905; appointed H. M. Commissioner for the International Boundary between Canada and the United States, under treaties of 1892, 1903, 1906 and 1908; also under agreements entered into in 1899, 1901 and 1906; appointed a member of the International Waterways Commission, 1904-7; a fellow (and hon. president since 1906) Royal Astronomical Society of Canada; a fellow American Association for the Advance of Science; F.R.S.C., 1908; vice-president, do. 1910; president, do. 1911; C.M.G., 1908; presented with a silver loving cup by members of his official staff, as a token of their loyalty, esteem and affection, 1911; author "Astronomy in Canada" and of various other scientific papers; an Anglican and a delegate to the Synods.—"Observatory House," Ottawa; Rideau Club.

A. H. HAWKINS, B.A. Sc., C.E., D.L.S.
President.

A. H. HAWKINS, B.A., SC., C.E., D.L.S.

Albert Howard Hawkins, oldest son of James, and Mary Doan Dean Hawkins, was born the 27th July, 1862, in the Township of York, near the town of Newmarket, Ontario. His father taught in several of the Public Schools in the County of York.

He attended the Public and High Schools, in Listowel, Ontario, and served his apprenticeship with the late Lewis Bolton, Dominion Land Surveyor, and graduated from the Faculty of Applied Science of McGill University, Montreal, in 1890, and going to British Columbia the same year obtained a commission as a Land Surveyor, and was employed with the firm of Garden, Hermon and Burwell, at Vancouver, B.C., in general engineering and survey work. He went to the Yukon in 1898, where various engineering and mining enterprises were engaged in. Returning from the Yukon in 1904, he obtained his commission as Dominion Land Surveyor in 1906, and has been employed on various surveys by the Topographical Surveys Branch since that time. Has been engaged on Base Line work since 1907 in various parts of the west.

Association of Dominion Land Surveyors.

OFFICERS FOR 1915-1916.

Patron:
E. DEVILLE, LL.D., D.T.S., Surveyor-General.

Honorary-President:
W. F. KING, C.M.G., LL.D., D.T.S.

President:
A. H. HAWKINS, D.L.S.

Vice-President:
J. J. MCARTHTR, D.L.S.

Second Vice-Presidents:
T. SHANKS, D.L.S., Ontario.
L. E. FONTAINE, D.L.S., Quebec.
J. W. HARRIS, D.L.S., Manitoba.
E. H. PHILLIPS, D.L.S., Saskatchewan.
R. W. CANTLEY, D.L.S., Alberta.
W. G. MCELHANNEY, D.L.S., British Columbia.
J. H. BROWNLEE, D.L.S., Yukon.
P. E. PALMER, D.L.S., New Brunswick.

Executive Committee:
E. M. DENNIS, D.L.S.
D. F. ROBERTSON, D.L.S.
D. H. NELLES, D.L.S.

Secretary-Treasurer
E. W. HUBBELL, D.L.S.

CONSTITUTION

ARTICLE I.

Name of the Association.

"The Association of Dominion Land Surveyors."

ARTICLE II.

Objects of the Association.

The promotion of the general interests and the elevation of the standard of the profession.

ARTICLE III.

Members.

1. The Association shall consist of Active Members and Honorary Members.

2. Active members must be Dominion Land Surveyors, and only such shall hold office.

3. Any Dominion Land Surveyor may become an Active Member upon payment of the fees prescribed by Article IX.

4. Honorary Members must be nominated by two Active Members, and the nomination approved of by a unanimous vote of the Executive Committee. The nomination, with approval, must be in the hands of the Secretary-Treasurer at least one month before the Annual Meeting. They shall be elected by ballot in the manner hereinafter provided for the election of officers of the Association. The number of Honorary Members shall not, at any one time, exceed ten, and they shall be exempt from payment of dues.

ARTICLE IV.

1. The Surveyor General of Dominion Lands shall be Patron of the Association.

2. The officers of the Association shall consist of an Honorary President, a President, a Vice-President, a 2nd Vice-President from each Province, a Secretary-Treasurer, and an Executive Committee, all of whom shall be nominated at the General Annual Meeting,

excepting the 2nd Vice-Presidents for the Provinces, whom shall be elected separately by each Province. The ballots to be sent members by the Secretary-Treasurer.

3. Voting for officers shall be by letter ballot, which ballot will be issued by the Secretary-Treasurer to all members on or before the 20th day of January, in each year.

4. The ballots are to be returned to the Secretary-Treasurer on or before the 20th day of March, in each year, to be opened and counted by him.

5. Candidates and retiring officers are to be notified by the Secretary-Treasurer of the result of the election.

6. The Secretary-Treasurer is to have a vote only in the case of a tie.

ARTICLE V.

MEETINGS.

1. The Annual General Meeting shall commence on the last Wednesday in January, at Ottawa.

2. Special meetings of the Association may be called by the President, or by the President when requested in writing by three or more members.

3. Nine members shall form a quorum at any meeting for the transaction of business.

ARTICLE VI.

Any member of the Association who may desire a change in the Constitution of the Association, shall give notice of such contemplated change to the Secretary-Treasurer, at least one month before the next Annual Meeting, and the Secretary-Treasurer shall, in his notice of such meeting to the members, notify them of the name of the party proposing such change, and the nature thereof.

No by-law or rule shall be altered, or new one adopted, except at a General Meeting, and such amendment shall be voted upon at the said General Meeting, two-thirds majority of the votes cast being necessary for its adoption.

ARTICLE VII.

EXECUTIVE COMMITTEE.

1. The Executive Committee shall consist of the President, Vice-President, Secretary-Treasurer, and three members, and shall have the direction and management of the affairs of the Association. Three members shall form a quorum.

2. The meetings of the Executive Committee to be held at the call of the President or Secretary-Treasurer.

ARTICLE VIII.

AUDITORS.

Two Auditors, to be elected by ballot, shall audit the accounts of the Association annually, and present their report of the same at the Annual General Meeting.

ARTICLE IX.

SUBSCRIPTIONS.

1. The fee for membership for Active Members shall be two dollars, payable in advance.

2. The fees of Active Members shall be forwarded to the Secretary-Treasurer with the ballot paper for election of officers, and any ballot unaccompanied by the fees mentioned in sub-clause No. 1, in case the said fee has not previously been paid, shall not be counted in the election.

BY-LAWS.

ORDER OF BUSINESS.

1. Reading of Minutes of previous meeting.
2. Reading of correspondence and accounts.
3. Nominations for Honorary Membership.
4. Balloting for Honorary Membership.
5. Reports.
6. Unfinished Business.
7. New Business.
8. Nomination of Officers.
9. Adjournment.

2. All motions must be in writing, and shall contain the names of the mover and seconder, and must be read by the Chair before being discussed.

3. Reports of Committees must be in writing, signed by the Chairman thereof.

4. No member shall speak on any subject more than once, except the introducer of the subject, who shall be entitled to reply; every member, however, shall have the right to explain himself, subject to the discretion of the Chair.

5. When a motion has been finally put to the meeting by the Chairman, all discussion thereon shall be closed.

6. The Chairman shall appoint two scrutineers when a ballot is taken.

7. Every member, while speaking, shall address the Chair.

8. Parliamentary Rules to govern in all cases not provided for in preceding sections.

Duties of Officers.

1. The President shall preside at all meetings at which he is present; in his absence, the Vice-President; and in the absence of both, the meeting shall appoint a Chairman.

2. The presiding officer shall only have a casting vote, not a deliberate one.

3. The Secretary-Treasurer shall keep an accurate record of all meetings, conduct all correspondence, announce all meetings, receive all fees and subscriptions and other moneys, pay no bills unless sanctioned by the Executive Committee and signed by their Chairman, make an annual report of all receipts and disbursements, and shall perform such other duties as may from time to time be assigned him by the Executive Committee.

Association of Dominion Land Surveyors.

NINTH ANNUAL MEETING.

OTTAWA, WEDNESDAY, JANUARY 27TH, 1915.

The Ninth Annual Meeting of the Association of Dominion Land Surveyors opened this morning in the Carnegie Library, President, C. F. Aylsworth, D.L.S.

Members present at one or more of the sessions:—

Dr. Deville; Dr. Klotz; T. Fawcett, D.T.S.; W. M. Tobey, D.T.S.; J. R. Akins, D.L.S.; C. F. Aylsworth, D.L.S.; H. G. Barber, D.L.S.; C. A. Bigger, D.L.S.; G. H. Blanchet, D.L.S.; W. J. Boulton, D.L.S.; E. P. Bowman, D.L.S.; A. J. Brabazon, D.L.S.; S. Bray, D.L.S.; J. H. Brownlee, D.L.S.; H. W. Cannell, D.L.S.; T. H. G. Clunn, D.L.S.; M. F. Cochrane, D.L.S.; G. W. Coltham, D.L.S.; P. M. Coté, D.L.S.; G. C. Cowper, D.L.S.; J. D. Craig, D.L.S.; P. W. Currie, D.L.S.; E. M. Dennis, D.L.S.; M. Dennis, D.L.S.; T. C. Dennis, D.L.S.; G. B. Dodge, D.L.S.; W. S. Earle, D.L.S.; C. Engler, D.L.S.; G. H. Ferguson, D.L.S.; F. D. Henderson, D.L.S.; E. W. Hubbell, D.L.S.; G. S. Jones, D.L.S.; F. H. Kitto, D.L.S.; G. J. Lonergan, D.L.S.; H. Matheson, D.L.S.; J. J. McArthur, D.L.S.; R. B. McKay, D.L.S.; J. B. Milliken, D.L.S.; A. M. Narraway, D.L.S.; R. Neelands, D.L.S.; D. H. Nelles, D.L.S.; N. J. Ogilvie, D.L.S.; H. Parry, D.L.S.; J. W. Pierce, D.L.S.; R. C. Purser, D. L.S.; G. L. Rainboth, D.L.S.; F. B. Reid, D.L.S.; C. Rinfret, D.L.S.; H. L. Seymour, D.L.S.; T. Shanks, D.L.S.; H. M. R. Soars, D.L.S.; I. J. Steele, D.L.S.; J. J. Stock, D.L.S.; A. G. Stuart, D.L.S.; G. A. Tipper, D.L.S.; L. A. Van Skiver, D.L.S.; C. R. Westland, D.L.S.; A. H. Whitcher, D.L.S.; O. B. Roberts, D.L.S.; W. A. Fletcher, D.L.S.; J. H. McKnight, D.L.S.; J. E. Woods, D.L.S.; S. D. Fawcett, D.L.S.; G. H. Watt, D.L.S.; F. Alport, D.L.S.; L. Brenot, D.L.S.; J. P. Cordukes, D.L.S.; A. J. Elder, D.L.S.; D. S. Ellis, D.L.S.; D. J. Fraser, D.L.S.; A. M. Grant, D.L.S.; W. L. Malcolm, D.L.S.; T. S. Nash, D.L.S.; W. H. Norrish, D.L.S.; F. W. Rice, D.L.S.; W. L. MacIlquham, D.L.S.; A. Roger, D.L.S.; J. E. Ratz, D.L.S.; R. L. Squire, D.L.S.; M. D. McCloskey, D.L.S.; R. F. Clarke, D.L.S.; B. C. Pierce D.L.S.; R. Callander, B.Sc..; W. D. McClennan; E. G. Timbrell, B.Sc.; J. D. Bradley; W. J. Lytle; L. Goodday, C.E.; E. E. D. Wilson, B.Sc.; D. A. Nichols, B.Sc.; E. F. Browne, B.Sc.; W. B. Armstrong, B.Sc.; H. E. Sutherland, B.Sc.; R. P. Bray; W. Murdie, M.Sc. W. C. Way, M.Sc.; N. A. Thompson, B.Sc.; A. Fraser, B.Sc.; A. H. Miller, B.Sc.; H. E. Hayward, B.Sc.; R. H. Campbell; The Minister; Dr. J. L. Chabot, M.P.; Major Rothwell; Col. Arnoldi; F. A. MacDiarmid, M.A.; P. B. Symes.

The minutes of the last Annual Meeting as published in the Annual Report were approved.

CORRESPONDENCE.

The Secretary read the correspondence that had been carried on during the year.

NON-PAYMENT OF FEES.

MAJOR HUBBELL: The last couple of years there has been a number of members who, although they have been asked to pay their Association fees, have either totally ignored the letters or have not paid. We have decided that some action must be taken. The fee is very small, only two dollars, and we think we will have to adopt drastic methods and remove the names of non-paying members after a certain number of years. If a member does not wish to retain his membership in the Association, the proper way is for him to pay up his dues and then resign. I wrote a letter to the executive asking their opinion, (letter read). I would like to have the opinion of the Association in connection with that.

THE CHAIRMAN: I would like to draw attention to the loss of the bust which is referred to in the correspondence. That became suddenly a very important matter, and the executive and our secretary have settled the matter and I would ask if any member has any observations to make on this point. I think we may consider the transaction as closed, that it is the view of the Association that the action of the secretary and executive has been entirely satisfactory and in the best interests of the Association.

PRESIDENT'S ADDRESS.

It is my pleasant duty to call together this, the Ninth Annual Meeting of the Dominion Land Surveyors Association, of Canada, held in the Carnegie Library in the City of Ottawa., We come here for social purposes, for professional benefits and to cultivate the indispensible Esprit de Corps. There is no profession that embraces the same function or the same diversity of function that the practice of the surveying profession does. The technical, the legal, historical and the executive functions. We annually gather together to compare notes and discuss papers on these functions, and any other past or prospective subjects that we consider of educational or practical benefit to us; that will broaden our view points; that will make us better surveyors, to the end contributing to the uplift of our profession.

I am only repeating a platitude when I state that the past year, and more particularly that portion of it since the beginning of last August, has been full to overflowing of stupendous events of vast and more far reaching importance to our beloved Canada than any that have ever occured to us before.

In one night about the first of last August, we Canadians were aroused from those beautiful, babylike, blissful slumbers, slumbers begotten of the greatest prosperity during the past number of years, that any country has ever known; prosperity in agriculture, railroading, financial and real estate and increase of population. in fact aroused from the refreshing slumbers begotten by a people living in a land flowing with milk and honey, "to find ourselves, and justly so, thrown into the Niagara whirlpool of European Militarism; transformed from a people always following peaceful avocations, not by any means inbued with the military instinct or tendencies to become one of the participants in this unparalled European war, we are proud to know that Canada has measured up to the test beyond our expectations.

Surveyors are patriotic; they know the potentialities of Canada from the East to the West and from the North to the South; and they know the difference between being governed by British institutions and being governed according to German ideas, and we are going to do our duty to protect ourselves from the latter fate, and if you will permit the mention of a personal point viz. that since my return from the West, Mrs. Aylsworth and I have plunged into patriotic work almost to the neglect of my other duties.

As our financial standing is in good condition, it may be advisable to discuss the question of this Association contributing to-day something towards some of the patriotic funds being raised, and as to-day happens to be the Kaiser's birthday, it would show to the world what we thought of him and the hell-upon-earth that he has been the cause of.

I have already described the financial condition of Canada previous to the outbreak of the war, but I will not dwell upon the economic condition in Canada since the outbreak, although I think it is conceded that legitimate business is fundamentally sound. You all read and you know the conditions as well or better than I do.

But there is one thing that we as Surveyors would like to know, and that is, how long will those conditions continue? I trust that the young Surveyors now growing into the profession will never experience the lean years that we older ones have; however, nothing is to be gained by projecting our heads into the sand, or not keeping our ears to the ground.

Mr. J. S. Dennis of Calgary, head of the Department of Natural Resources of the C. P. Railway was congratulated upon the plain, frank statements of facts concerning the economic conditions in Western Canada, which he made before a convention of public men in Edmonton in unequivocal language. Mr. Dennis who has lived in the West for 40 years and has played no small part in its development, told his hearers that banking, railway construction, municipal and all manner of work, has advanced ten years ahead of the times. For instance, the Assistant to the President of the C. P. Railway, pointed out that in the three Western Provinces there is one mile of railway for every 122 people in the cities and one mile for every 74 people on the land. No other nation on the face of the globe to-day has such an extensive equipment.

In the opinion of Mr. Dennis, settlement and production must overtake the present commercial and railway facilities that have been provided. This opinion of Mr. Dennis is worthy of consideration. It may point to a policy of watchful locating until the present unequal conditions are rectified.

It has been noted in this and other similar organizations, that after members have obtained the highest honours of the Association, that with few exceptions, such as our worthy Secretary, that their interest in our Association gradually diminishes to almost the vanishing point, such should not be the condition. Our Association is small numerically, and the majority of us are small financially, and great distances separate our members so that this condition should serve to stir us one and all to nobler deeds, to the end that this Association may become the driving power to the goal of our professional ambition, viz. that the surveying and engineering profession may become the leader of them all. "By their works ye shall know them."

Does this mean, as Professor H. E. T. Haultain asks in the Canadian Mining Journal recently, are we merely "hewers of wood and drawers of water." The public never recognize the achievements of Surveyors by erecting monuments to their memories; we do not covet such recognition. We look askance at all personal publicity, but in the prosecution of our professional duties, we are erecting monuments by and through which our memories will be perpetuated. The legal penalty for the destruction of even one of the Surveyors innumerable obscure monuments is as great or greater than for the destruction of any other monument. It is only the other day that we recieved instructions from our always progressive Surveyor-General to offer suggestions of design of a more immovable and non-destructible monument. The Surveying profession is one that hands the surveyors name down to posterity to a greater extent than any other. There is nothing in the education, training or practice of the surveyor that has the slightest tendency to incline him otherwise than an honourable man. The whole tendency of his practice is to cause him to be honourably judicious.

We are not seeking the trapping of knighthood, the garb of the cleric, the gown of the Jurist or lawyer, nor the mortar board of the professor.

When statesmen are elevated to cabinet rank they are addressed as honourable—a discussion of this immemorial practice, however, belongs to another time, but I would suggest that surveyors along with judges, only have the title of Honourable prefixed to their names.

Now this is the tale of labours performed by a survey gang,
Away in the back of the wild lands where nobody cares a hang,
Where the brown bear howls in the thicket, and the screech owl splits the night,
And skunks and other blossoms sweet, yield scents of rare delight.

When grey the dawn is breaking, your duties are begun,
Throughout the hours of daylight, you labor in the sun.
And when the shadows lengthen, and the stars are shining bright
You take a shot at polaris in the middle of the night.

But its not bad work in summer, its rather fine in the fall,
But in the good old winter its the greatest job of all;
With frozen ears and fingers, and nose that you cannot feel,
You laugh aloud with your stiffened lips, for you're doing the work that's real.

With apologies to R. S. Bartram and R. W. Service.

With your permission I wish to congratulate the Hon. Mr. Hearst on his elevation to the Premiership of Ontario. Mr. Hearst has distinguished himself by being a friend of Surveyors. I also wish in this way to make special mention of the Hon. Dr. Roche, Minister of the Interior, having been the guest at our last Annual Banquet. Doubtless such tactful characteristics contribute in no small measure to their promotion. I notice that this Association possesses the happy faculty of holding its friends.

I do not know upon what grounds, but it has been asserted, that this Association is prejudiced against some of the Provincial Associations. Please permit me to state that so far as I am aware no such feeling exists here, either as an Association or as individuals; on the contrary we extend greetings to them and hail them as the product of the desire to elevate the professsion.

It is with deep regret that I mention that during the past year the hand of death has fallen upon the late A. W. Ponton and A. E. Hunter.

I desire to see this Association become such that it will be recognized as a privilege and an honour to be a member of it. I would like to see such a question as the prevention of stream polution taken up, and other questions such as good roads and the development of Water powers.

Lastly, I wish to thank the members of this Association for all the honours that they have showered upon me. This will be the third time that I have had the exceptionally distinguished and deeply appreciated honour to preside over your deliberations.

> "The bridgroom may forget the bride was made his wedded wife yestere'en;
> The monarch may forget the crown that on his head an hour has been;
> The mither may forget the bairn, that smiles so sweetly on her knee;
> But I'll remember thee, Glencairn, and a' that thou hast done for me".

C. F. AYLSWORTH.

SECRETARY-TREASURER'S REPORT.

OTTAWA, JANUARY 27TH, 1915.

MR. CHAIRMAN:—

Having been re-appointed Secretary-Treasurer at the last Annual Meeting of the Association, I have the honour to lay before you the report of the business of our Association transacted between the 4th March, 1914, and the 27th January, 1915.

After revising the minutes of the last Annual Meeting, I compiled the different information and placed the matter in the hands of R. J. Taylor, Book and Job Printer, Ottawa, for publication.

Five hundred and fifty (550) copies were printed at an average cost of 55 cents per copy.

Copies of the Annual Report were mailed to the address of all members of the Association, who were in good standing, also to those who were two years and under in arrears with their annual fees, besides those on the following list:—

Ontario Land Surveyors Association	150	copies
Advertisers	7	"
Surveyors who received Commission in 1914	28	"
Alberta Land Surveyors Association	10	"
Various persons	13	"
Reports of 1913	37	"

We still have on hand about 100 copies for distribution or sale. We received from the Ontario Land Surveyors Association 150 copies in exchange for an equal number of our reports. Most of these were distributed to members of our Association, who were not members of the Ontario Land Surveyors' Association.

Our thanks are due to the Commission of Conservation for the receipt of one copy of each of their publications.

Last year 62 letters were received and 120 letters sent out, apart from 28 applications for membership, 144 letters re. arrears in fees, 225 letters re "papers for annual meeting," 200 ballots in connection with the election of second Vice-Presidents for each of the Provinces.

The official list of members has been revised from time to time as changes occur, and now tabulates as follows:—

Hon. Members	9
Active Members	225

During the past year the name of two members have been added to the deceased list: Mr. A. E. Hunter and Mr. A. W. Ponton.

One member has resigned: Mr. J. A. Kirk.

Seventeen newly licensed surveyors have been added to the active list.

Three meetings of the Executive Committee were held during the year.

Acting upon the recommendation of the Executive Committee, the names of 23 members were struck off the list of active members on account of arrears, (non payment of fees for more than three years).

During our session of the last Annual Meeting at the Carnegie Library, one of the attendants, whose name we have been unable to ascertain, had the misfortune to break a bust of the late Lord Minto.

The Executive Committee, after consulting Mr Ainsley Green, Barrister, Ottawa, on the subject, were advised by him that although the Association was not legally responsible for the destruction of the Bust, it might, however, be considered morally so, and that some compensation should be awarded the sculptor, Mr. Hamilton McCarthy. To this the committee agreed, and Mr. Green prepared a formal release for the amount of $75.00 which was paid the sculptor. A fee of $8.00 was also paid to Mr. Green for professional services.

The above statement will account for the expenses being this year higher than previous years.

The financial statement herewith shows the various business transactions during the past year and the present condition of the Association finances.

Statements of receipts, expenditures and balance between the 4th March, 1914, and the 27th January, 1915.

RECEIPTS.

March 4, 1914, Balance on hand	$717 95
Advertisements in report	39 00
Dinner tickets (sold 51 at $2.00)	102 00
Annual fees 1911 and 1912	12 00
Annual fees 1913	28 00
Annual fees 1914	228 00
Annual fees 1915	46 00
Government grant	125 00
Excess commission on cheques	1 00
Interest	15 43
Amount received from R. M. Gourlay, being fee due to D.L.S. Board of Examiners	22 00
Total	$1,336 38

EXPENSES.

Chateau Laurier dinner bill for 1913-1914	$170 70
Tip to waiter	2 00
Services of Stenographer	75 00
Grant to Secretary 1913-1914	75 00
Grant to Secretary 1914-1915	75 00
Printing report and circulars	325 60
Hamilton McCarthy, Sculptor	75 00
A. Green, Barrister	8 00
Commission on cheques	4 20
Advertisements in Ottawa papers	16 20
Board of Examiners, R. Gourlay's fee	22 00
Postage stamps and small items	3 50
Amount deposited in Quebec bank	484 18
Total	$1,336 38

Audited and found correct,

(Sgd.) T. S. Nash.
E. M. Dennis. *Auditors.*

January 25th, 1915.

Major Hubbell: I might say in connection with the annual banquet, that it is not a financial success, as we always have a good many guests at the banquet and the Association, of course, pays for them. Our last annual dinner cost us $170.00 and our receipts were $102.00 leaving a loss of $68.00. I think it is desirable that we should have present at this banquet members of Parliament, as they have always shown themselves to be friends of ours, and it has been a custom ever since the Association was re-organized to have these gentlemen present. It keeps them in touch with surveyors and their methods, and I am sure that when surveyors require to have something done by Parliament these members will be only too glad to help us out whenever possible. By having these gentlemen present, as I said before, they are kept in touch with our actions and become conversant with our work. Of course both sides of politics are represented. Lately we had the honour of the presence of the Minister of the Interior and we shall have his presence again to-morrow evening. I think the Association can well afford to spend a few dollars in entertainment of this kind. We have about 230 members and the fees amount to about $460.00, and then we have the Government grant of $125.00. But that is not sufficient to cover the printing of our reports which have been very heavy this year, as some of the lectures delivered last year were very scientific and had illustrations, and so the printing cost a good deal. I hope next year to ask for an increased grant from the Government, probably double the amount we now receive. I hope that the financial statement meets with your approval. I have done my best to keep the expenditure as low as possible and we have still a balance to our credit of nearly $500.00.

THE CHAIRMAN: I am sure that I am in sympathy with the remarks of our worthy Secretary. While it may appear that the cost of our annual banquet is large, still when you compare the cost of our banquet with the banquets of the Provincial Associations you will come to the conclusion that we are a bunch of tight-wads. For instance, compared with the banquet of the Ontario Land Surveyors or the Manitoba Land Surveyors, the cost of our banquet is altogether within bounds. I think it is a good thing for our Association to invite guests as the Secretary has said. Last year, the Hon. Dr. Roche, the first Minister of the Interior to ever attend a Dominion Land Association meeting, came to our meeting and I think he was delighted with the results and with the treatment accorded to him. Our Secretary had written him and asked him to come to the annual banquet and I interviewed the Minister and although, as you know, his health is very poor, I suggested that we should arrange our banquet to suit his convenience so that he need only remain a few minutes, but he said "No, I am going to your annual dinner, I would not miss the Surveyors annual dinner for anything, and I am going to stay through the whole programme." We may say of the surveyors "What we have we'll hold;" when we get friends we hold them. Mr. Hearst, now Prime Minister of Ontario, was the first Minister to ever attend the annual meeting of the Ontario Land Surveyors, and perhaps as Premier he may attend their banquet again this year. I think it is our duty to recognize our friends and stand by them in every possible way, especially when they stand by us.

To-day is the Kaiser's birthday. I think it would be appropriate for us to hand out to the Kaiser a birthday present in the shape of a contribution to the patriotic fund, to help undo the hell-on-earth he has caused to the world and to show our appreciation of his services. We have a substantial balance on hand and I think we could well afford to contribute something to the patriotic fund. Would any person make a motion to that effect?

It was moved by Mr. Dodge, seconded by Mr. Lonergan, that $100.00 be contributed out of the funds of the Association to the Patriotic Fund.—Carried unanimously.

THE CHAIRMAN: Referring to the point brought up by Mr. Palmer in his letter that was read by the Secretary, about reporting on the quality of men, I think that owing to the financial and economic disturbances in Canada, perhaps the labour question will not by as acute in the future as it has been in the past, but still this suggestion is very well worth of consideration and I am sure that the matter has been receiving the attention of surveyors. I would like to hear what the Association thinks on this important subject?

MR. AKINS: I think this is a good idea. If each surveyor would send in to the office of the Association a report on the men he has employed during the season, qualifying them as excellent, good, fair and no good, then if a copy of the list thus prepared could be sent to each surveyor as he went out he could easily tell which men applying for employment were good men. It is generally the same men who work on the surveys from year to year. If a man does good work for one surveyor he would do good work for another the next year. Such a system would greatly assist a surveyor in organizing a party.

MR. LONERGAN: Every surveyor manages his own party in his own way. A man who would be good for one might be no good for another. I have known surveyors to turn down men, saying they were no good, just because the surveyors were cranks while the men might turn out to be good men under other management. It might be possible that through this system injustice might be done to some good men. It might be feasible and it would do no harm to try it.

MR. BLANCHETTE: Who would look after that?

THE CHAIRMAN: Perhaps this Association, or perhaps it might be done through the Surveyor General's office.

MR. BLANCHETTE: I think it would be a better idea for the Association to handle it than the office of the Surveyor General.

MR. LONERGAN: I think it would be better for the Surveyor General to handle the question. It would make a lot of extra work for our Secretary.

MR. HENDERSON: I do not know that I am competent to speak on this particular phase of the subject. It is a very serious matter to make up a black list. You might call it a black list of men. I am of the opinion that the Surveyor General would not have anything to do with it. If it was done, it would have to be done by this Association. The idea seems to be a good one and Mr. Lonergan's objection does not seem to me to be a very serious one, because with the report of any man would go the name of the surveyor making the report, and then the chief who was looking for a man would say: This is John Smith who applied for a position and John Brown has reported against him. I know John Brown, his opinion is not worth very much and that would regulate itself.

Mr. Blanchette: There might be a single list kept, it would not be necessary to send a copy to each man.

Major Hubbell: This question is important to all surveyors, especially those working in the field. We have all had men asking for jobs, and when we ask them what are their qualifications they say: I worked for Brown. Yes, how long were you with him? Three months, six months or nine months. You have no means of ascertaining whether the man is lying or telling the truth. The difficulty applies chiefly to cooks. I have had a great deal of experience with those gentlemen, and I tell you some of them are so bad that if surveyors knew about them among themselves they would be much better off. We engage a cook and then when we have been at work perhaps about a week, we find that he is not worth anything. It upsets the whole party when you have to dismiss the cook before you can get another one. I think the suggestion is a good one and it would work successfully if the surveyors themselves would take the matter in hand and would not have to be urged a dozen times to send in their list. If they will send me a list at the end of the year of the men employed in their party, grading them according to their qualifications, I would keep that list in my office and then any surveyor who wishes to know the qualifications of any man could either see that list in my office or wire from wherever he might be about that man.

The Chairman: Would you have it in your office or in the Surveyor General's office?

Major Hubbell: If possible in the Secretary's office.

Mr. Lonergan: Wiring might cause two days loss of time.

Major Hubbell: When engaging a man you generally hold off for a day or so and there would really be no loss of time in wiring to me. In fact it might save time in the long run.

Mr. Lonergan: Could the surveyors have the list when they were going out in the spring?

Major Hubbell: Yes.

Mr. Lonergan: Supposing a surveyor black-lists a man and the man takes action.

Major Hubbell: I do not think it would be necessary to go that far.

Mr. Lonergan: Would not the surveyor start to protect himself in the first place by giving every man a recommendation?

Major Hubbell: Of course it would all depend on the surveyor himself, and how he graded his men.

Mr. Watt: I cannot understand a man sending to the Department a list of his men when he knows that list will be available to all other surveyors. When a man has trained people to work under him he will protect them. I do not think that some surveyors would give the Association the names of their good men, especially if they intended to go right back to that district in the next summer, and it is quite probable that they would have promises from these men to work with them in the next year.

Mr. Lonergan: If a man was a good man the surveyor would keep him for himself and perhaps not put his name on the list.

Mr. Watt: It might resolve itself into that kind of a list.

Major Hubbell: If a surveyor has some good men one year and tells them that in the next year he will have a survey party in that district and asks them to come with him again, he need not be afraid that any other surveyor will get these men from him. Let us be open with each other in this matter. I think if any man worked for me and another surveyor tried to take him from me, I would not let the man go if I wanted to keep him. I might keep the list suggested in my office, I could, if necessary, keep it under lock and key and if any surveyor desired to know about a man, I could give the information quietly.

The Chairman: I think that is a good idea of Mr. Watt's about the danger of giving other surveyors the names of good men. That might be overcome by having a black list of poor ones and not mentioning the good ones.

Mr. Lonergan: Then you would leave out some of the party?

Mr. Chairman: Leave it to the fellows who are incompetent or disturbers of the peace or who fall by the wayside in any way.

Mr. Lonergan: I am afraid the idea is not practicable. The only way would be to have a complete list of good and bad, and have each surveyor have a copy in his office when he goes out and of course have the surveyors keep the list quiet.

The Chairman: You could include on the black list the name of the surveyor who gives him the black eye.

Mr. Dodge: It is not a point on which I have any knowledge. It seems to me on the face of it that the right plan would be for the surveyor to make a report on every man working for him, good, bad and indifferent. Of course if I were out in the field I might modify those ideas.

The Chairman: You might have a good party in the field one year and the next year when you went to the same district some other surveyor would be ahead of you and get all your good men.

Mr. Dodge: If I had good men working for me and expected to go back in the same district the next year, I would ask the men if they would come with me the next year and would expect them to wait for me. I would probably write in advance and keep in touch with them. If you restrict your list only to a black list you will find in a very short time that the surveyors will be chary and the black list will come to nothing. If you ask the men to make a report on every man then that can be done.

Mr. Henderson: How would it be if for this year the surveyors reported only on the cooks?

Major Hubbell: The cooks, of course, are the important men. If a man is a bad cook, a surveyor would have no hesitation in knocking him hard as he could, so you would be sure to get reports from all surveyors.

Mr. Blanchette: Why not include chain men and packers as well as cooks?

Major Hubbell: What Mr. Dodge says is right; I think the surveyors should report on every man in the party. It is for the good of the profession, we must not look at it from a narrow viewpoint. A man who has been working say in Saskatchewan, and is then sent to Alberta or British Columbia, does not know anything about the men who apply to him for work, he cannot always size them up. I emphasized the point about cooks because they are the head of the whole survey outfit, not even excepting the chief himself. I might address a circular letter to each surveyor and leave it to them whether they would report on all their men or not, but I think it is for the benefit of the Association that a surveyor should know about the qualifications of the men he is engaging.

Mr. Seymour: It seems that the object of this report on the men is two-fold, primarily so that the surveyors will not get poor men on their parties, but also to enable a surveyor when going into a new district to make up a good party. It seems to me that the machinery necessary to get reports on these men would not be very complicated, that probably a surveyor would be willing to send a report on his men to our Secretary, Major Hubbell, and then an easy way to distribute these reports would be to have them at centres such as Edmonton, Prince Albert, Calgary and so on, so that a surveyor could learn about available men at each centre. As to taking good men away, of course, in a place like Edmonton you may have twenty surveyors fitting out parties, each surveyor knowing the men. Practically it works out that if you are once in touch with a man you keep in touch with him to a certain extent, and the next year you have no difficulty in getting him. I do not think that the list would make any difference in that way.

The Chairman: I think it is a good idea to have this list. One of the objects of an Association like this is to cultivate esprit de corps, to have a certain amount of professional ethics. In the courts of law it is contrary to legal ethics for one side to interfere with a witness on the other side. In medicine it is recognized as a wrongful act for one man to butt in on another man's patient. Here is where surveyors should try and cultivate esprit de corps. We should adopt a resolution that no surveyor should look over the list, see which surveyor had the best men, and try to get them away from him. That should be tabooed. On all other grounds I am in favour of the idea of publishing our lists of men and having it placed with our Secretary who would make it available to the surveyors. I think the idea of looking over the list, finding out the good men and taking them away from a man who may not be in the field as soon as the one using the list, should be tabooed.

It was moved by Mr. Akins, seconded by Mr. Lonergan; "That a circular letter be sent to each of the surveyors asking them to send in a list of the names of the men employed by them during the season, arranging them in relation to their desirability as employees on Dominion Land Surveys."—Carried.

Major Hubbell: At these Annual Meetings of our Association, the stern duty falls upon me to bring to the notice of the members, the names of surveyors who have crossed the "Great Divide" since our last meeting. I regret to have to inform you, that during the past year two of our comrades, Messrs A. E. Hunter, of Wiarton, Ontario, and A. W. Ponton of Edmonton, Alberta, have joined the great majority. Most of you are doubtless aware of the sudden and tragic death of Mr. Hunter, who was accidentally drowned, last July, in the Salmon river, B.C., whilst carrying on his surveying operations. It is to be regretted that this is not the only case of a surveyor who has met his death during the performance of his duty. It appears to me, that surveyors who die or are killed when engaged upon Government surveys should receive, at least, similar consideration and compensation from the Government as our soldiers who are killed in action. I think this is a subject that should be seriously discussed and followed up by our Association.

The other member, Mr. A. W. Ponton (Archie) so well known to us all (and a dear personal friend of mine) was one of the pioneers of Canada's Great West. In 1883 he became connected with the Indian Department, a position he held for twenty years. One of his principal surveys for the Dominion Government was the production of the fifth meridian to the north boundary of township 112. During the past two years he was engaged on contract work in northern Alberta.

Mr. Ponton had splendid qualities, friends innumerable, was an excellent surveyor, and under all circumstances, the gentleman. He will be greatly missed by his brother surveyors with whom he was an unusual favorite and good friend.

I move a resolution of condolence be passed by the Association, expressing our sincere sympathy with families of the two deceased members.

Mr. Norrish: Mr. Chairman, I beg to second the motion, particularly as I was associated with Mr. Hunter on last year's work. I was not associated with Mr. Ponton. I would ask that a letter be sent to Mr. and Mrs. James Hunter, the parents of the deceased. Mr. Hunter was a young man, one of our youngest surveyors, twenty-six years of age, a graduate of the University of Toronto, Faculty of Applied Science. I do not know under whom he served his time, but I know that he was a Dominion Land Surveyor, Assistant to Mr. St. Cyr, in 1912. He took charge of his first party in 1913, in British Columbia, working on exceptionally rough work.

The Chairman: I do not think that anything I could say would add to your sorrow in the death of Mr. Ponton. He was well known throughout Canada. He practised in my own county town and was very highly thought of. In all my experience throughout the West and other parts of Canada I never heard the name of Archie Ponton mentioned otherwise than as that of an honourable man. I am sure the Association and profession has suffered a severe loss in the death of our old friend Mr. Ponton.

Motion agreed to.

MR. HENDERSON: Have any members of our Association volunteered for the war?

MAJOR HUBBELL: I intended to speak of that. I am very pleased to say in reply, yes. At least one dozen Dominion Land Surveyors are on one or other of the contingents, having volunteered for the war. I wish there were one hundred of them. I had an interview with General Hughes and I explained to him that Dominion Land Surveyors were particularly well adapted for warfare of this nature. You have heard all about the trouble that many of the men at Salisbury Plain have had with their boots. It is astonishing the class of boots that these soldiers have been fitted out with. Surveyors, from experience, know the class of boots that should be worn on such occasions. I think we have all graduated in mud and water and various other things. Surveyors, who live eight or ten months under canvas in various climatic conditions, putting up with all kinds of fare and hardship, are the men who to-day should be at the front. I do hope that more will make application to get to the front. Personally I was one of the first to apply to go and I am at present engaged doing all I can to help organize the artillery brigade in Ottawa, and I hope that before long I shall have the pleasure of going overseas. I would like to see as many of my confreres there as possible. I do not know the exact number of surveyors who have volunteered, but I am surprised to see some young married men with young children volunteering. I think that surveyors have a hard enough time, and will have for some time to come, making a living; I am referring now in particular to a surveyor, one of the first to volunteer for overseas service, a young man with a wife and two small children. His duty, and the duty of men like him, I think, is at home. It is the duty of all young men who are single and who have no family ties, to volunteer and it should be their ambition to go to the front. We have a number of our men in the service, and I am sure that when our Canadian surveyors get to the front, they will be favorably spoken of.

MR. LONERGAN: Would it not be well to remit the fee of surveyors who have volunteered for the front?

Major Hubbell: The wife of one surveyor who has volunteered, wrote me asking me if it would be necessary to pay the fees, and I replied that as the fees were very small it would not be necessary to pay them now, that we could wait until the return of the surveyor from the war.

Mr. Dodge: I move that the fees of any member of the Association at the front should not be collected.

Major Hubbell: I second the motion. I think that under the conditions when surveyors go to the front the least we can do as an Association is to mark their fees as having been paid for the year.

Motion agreed to.

Mr. Dodge: I would suggest that, if possible, the Secretary-Treasurer should include in the annual report a roll of honour, giving the names of the Dominion Land Surveyors who have gone to the front.

The Association took recess.

The Meeting resumed at Three o'clock p.m. Mr. Aylsworth presiding.

The Chairman: Gentlemen, this is one of the largest gatherings we have ever had at our meetings. This afternoon we shall have a paper from Mr. Dennis. Mr. Dennis is on the inside staff of the office, an old experienced surveyor, so far as the office is concerned, and very thorough in all his work. He was for one year Secretary of this Association and we all remember with what thoroughness he did his work on that occasion. I am sure you will all be surprised at the thoroughness and accuracy of information that will be displayed in his paper.

THE HISTORY OF THE SYSTEM OF DOMINION LANDS SURVEYS.

E. M. Dennis, B.Sc., D.L.S., 1915.

The history of the system of survey Dominion Lands takes us back to the year 1869, when the territory of Rupert's Land was acquired by the Dominion of Canada from the Hudson's Bay Company. The only surveys in the country at that time were comprised in a number of lots fronting on the Red and the Assiniboine rivers near Fort Garry.

To the Department of Public Works was first assigned the duty of proceeding with the survey of such portions of this vast area as were thought likely to be required for immediate settlement. The method proposed for the survey of these lands, as adopted in 1869, provided that:—

1. The system should be rectangular, the townships to be numbered north from the international boundary and east and west from a given meridian.

2. A township should consist of sixty-four squares of 840 acres each, of which 40 acres was an allowance for public highways.

Sixty miles of the Winnipeg Meridian, a few township outlines and the subdivision of a small tract of land in the vicinity of Oak Point were the only surveys carried out in 1869, as the Red River rebellion breaking out in the Autumn put an end to the surveys for that year and also for the following year. During the year 1870, however, considerable attention was devoted to the system of survey.

In 1871, Lieutenant Colonel J. S. Dennis, Provincial Land Surveyor, was appointed Surveyor General of Dominion Lands, and the control and administration of these lands was transferred to the Department of the Secretary of State, the branch dealing with them being known as the Dominion Lands Branch. In this year also, the first Manual of Survey was issued for the instruction of Deputy Surveyors, a Deputy Surveyor being any surveyor duly qualified to survey Crown lands in any province of the Dominion. The system of survey was considerably modified from that adopted in 1869.

The country was to be subdivided into rectangular townships containing thirty-six sections, each, one mile square and surrounded by road allowances one chain and fifty links in width, these townships to be numbered northwards from the international boundary and east and west from the Winnipeg Meridian; the system, generally, being what we know as the First System of Survey.

The country was first laid out into blocks, each consisting of four townships and lying between a base and a correction line, and between two meridian outlines two ranges apart. In outlining one of these blocks the surveyor first ran the base line across two ranges, correcting his bearing at the midway township corner by observation. He next ran the meridian outlines north or south to the correction line, noting the closings, provided the opposite side of the correction line had been run previously. The correction line was next run across the two ranges.

If the opposite side of the correction line had been previously run, the other side was run one chain and fifty links from the line of monuments, and after ascertaining the total distance, the intervening township corner was established midway. The surveyor then proceeded to lay off the quarter sections each forty chains in width, starting from the east and proceeding westerly, leaving the excess or deficiency in the westerly quarter section of each range. If the opposite side of the correction line had not been previously run, he ran the twelve miles, first as a trial line and then as a true line, dividing the distance as already explained. This completed the block.

Sometimes, however, the correction line was run first, the monuments with the exception of the second township corner being planted permanently. This was done by establishing the first township corner at the theoretical distance. After the meridian exterior was projected from the base line, the second township corner was moved east or west as the case might be to put it on the meridian exterior. In running random lines across two townships in laying out blocks, if the line did not intersect the proper point within two chains, the several lines had to be retraced to locate the error. Only one side of a correction line was to be run at once but the two lines must be parallel and precisely the width of one chain and a half.

It was provided that in running base and correction lines, or meridian exteriors, instruments of the best make, graduated to at least ten seconds of arc, must be used. The transit theodolite, without vertical circle and with six inch limb was recommended. For township subdivision or traversing, a transit, theodolite, or solar compass, reading to minutes was sufficient. The chain used was the old one hundred link chain which must be tested and corrected at least every other day during use, by a standard measure. In ascertaining the distance over uneven ground, the measurement was obtained by "breaking chain." After every tally the fore and rear chainmen interchanged positions.

The astronomical meridian was determined by observation of the elongation of Polaris at night. A point was to be fixed not less than one hundred and fifty yards distant directly below the star at elongation. The line through this point and the point directly underneath the transit made an angle with the true meridian equal to the azimuth of the star. A table of the azimuths of the star for each year for the even degrees of latitude was appended, the azimuths for intermediate latitudes having to be calculated by interpolation.

On block outlines an observation should be taken at least on every township outline. Preliminary to the subdivision of townships the block was quartered, first by trial and then by true lines, by joining the opposite township corners as already established.

In making the subdivision, the surveyor commenced on the easterly meridian of the township and worked north or south from the base line, running one mile of the meridian parallel to the easterly outline of the township, and then running the chord easterly, the quarter section corner being planted midway on line between the section corners. This was continued until the other outline of the township was reached, the last mile of the meridian being deflected to hit the post on the outline and being divided equally to locate the position of the quarter section corner.

The next westerly meridian was then run in the same manner but in the opposite direction, and then the next meridian in the same direction as the first, etc. When running the westerly meridian of the township, in addition to running the chord lines easterly, the chord lines westerly closing on the township outline were to be run, making the easterly quarter sections exactly forty chains and leaving the excess or deficiency in the westerly tier of quarter sections. In the case of a township adjoining a correction line, any north or south error was to be carried into and appear in the tier of quarter sections adjoining the correction line. East and west section lines, except those in the westerly tier, were to be within fifty links of eighty chains in length. The north and south boundaries of any one section, with the same exception noted above, were to be within fifty links of equal width.

If the line was obstructed by a lake, pond or other obstacle, it was continued on by means of right angled offsets or a triangulation, in the latter case the measured base being not less than one half the estimated distance across the obstacle. In working around a large obstacle on a base line regular township and section lines were to be surveyed and the monuments permanently established.

Both banks of all navigable rivers and all lakes and deep ponds of twenty-five acres or more, together with all islands, were to be traversed. In traversing a lake entirely within a section, the traverse was to be connected with a monument on each of the opposite sides of the section. A traverse point was to be established at every intersection of the surveyed line with the bank of a river or lake, and the traverse was to be made by joining up these points by one or more straight lines following along the bank to be traversed. A traverse within a section or between two traverse hubs must close within one chain.

MONUMENTS.

A solid iron bar, five feet long, was driven to within fifteen inches of the top at each corner of the block of four townships when such corner was in the prairie. These bars had ragged corners for the lower three feet to hinder them being pulled up. For all other corners whether a township, section or quarter section corner, the monuments were to be as follows:—

In timbered country if a tree was found at the precise corner it was squared and marked. If not, a wooden post was planted and the position of the corner further defined by one or more bearing trees marked "B. T." with a scribing iron. At a township corner, a five inch post was squared to three and one half inches, driven one foot into the ground and projected thirty inches. At a section corner, a four inch post was squared to three inches, driven one foot into the ground and projected two feet. At a quarter section corner, a three inch post was flattened on two faces, driven one foot into the ground and projected eighteen inches. If a suitable stone could be readily found, it was planted and marked for the corner. In the case of a township corner, a small pyramid of stones was built beside the stone. If in timbered country, bearing trees were also marked.

In prairie country the wooden post was surrounded by a mound, six feet square at a township corner and five feet square for other corners, the post showing ten inches above the mound. In the case of a quarter section corner the mound only was sufficient if wood was hard to get. These mounds were to be covered with sod, grass side up, wherever practicable. The mound at a block corner where an iron bar was driven was placed so that the bar stood at the northerly corner of it except on correction lines, when the bar stood at the middle of the north or south side of the mound according as the monument defined lands north or south of the correction line. The mounds were made from earth taken from four rectangular pits which were dug big enough to provide sufficient earth. The centres of these pits were to be two feet six inches outside and opposite the centre of the base of the mound. The lines connecting the cardinal points would pass through the angles of the post and the mound, except on correction lines where they would pass through the centres of the post and mound. When a township or section corner fell in an unfavourable spot for the planting of a post or the erection of a mound, a witness mound was established similar to a mound at a section corner. The distance from the witness monument to the true corner was recorded in the field notes. Posts at township corners, except on correction lines, were marked on each of the four faces with the township and the range number towards which the marking faced. On a correction line, a township corner post was marked on the west side with the section number west of it, on the north or south side with the township and the range number north or south of it as the case might be, and on the other two faces with "R" for road.

All section corner posts except those on a correction line were marked on each face with the section number towards which the marking faced. In addition the township and range numbers were marked on one of the faces. In the interior of a township or on the east outline this additional marking was on the south west face, but on the north outline, it was on the south east face. On a correction line, a section corner was marked on the face towards the road with "R", on the opposite face with the township and range numbers. and on the other two faces, with the adjoining section numbers. In addition on all posts the letter "W" or "E" followed the range number indicating west or east of the principal meridian.

The markings on trees and wooden posts were to be made with a scribing iron, and on iron bars and stones with a cold chisel.

The field notes should be a faithful, distinct and minute record of everything officially done and observed by the surveyor and his assistants in relation to running, measuring and marking lines, establishing boundary corners, laying off road allowances, etc., and present as far as possible a full and complete topographical description of the country surveyed. The index should show the pages on which were the notes of each section line and each traverse line. The field notes were to include the lengths of the lines, the direction in which the lines were run, the topography, the nature of the soil, timber, water, minerals and geological features. Where rock in place was encountered a sample was to be sent in to the Department.

In addition to the field notes, all surveyors were required to submit plans on a scale of forty chains to an inch showing chainages, areas, objects of topography, etc., necessary to illustrate the field notes. Each township plan also gave the total area of land, water and roads within the township. All surveys were done under contract with the exception of the survey of some settlement lots where the surveyor was paid a daily rate. A contractor was required to enter into a bond, jointly with two sureties, to the Crown for double the amount of the contract, for the due and faithful fulfilment thereof. The lines were to be run by the surveyor in person, and the work would be inspected in the field to see that it had been properly performed.

At the time of the acquisition of the North West Territories the settlements were, with one or two exceptions, confined to the banks of the Red and Assiniboine rivers, where the people were found to occupy the lands in narrow lots fronting on these rivers and extending back an average depth of about two miles. These lots were surveyed into parishes, giving the settlers, as far as possible, the actual land of which they were in possession.

The blocks around the posts of the Hudson's Bay Company, reserved under the deed of surrender, were surveyed under the instructions of the Surveyor General, as were also the reserves, provided for the Indians under treaty.

In the next year, 1872, the rule was adopted that all future block outline surveys should be performed by parties under daily pay and allowances.

In this year also the Dominion Lands Act was passed defining the system of survey and regulating the admission of surveyors to practise on Dominion Lands.

In 1873 the management and control of Dominion Lands was transferred to the newly constituted Department of the Interior.

In 1874 an Order-in-Council was passed authorizing a special survey of base lines and meridians through the North West Territories and extending to Peace river. The positions of these bases and meridians were to be checked by means of a continuous triangulation to be carried on simultaneously over the most favourable belt of country that could be found for that purpose.

In the Surveyor General's report of 1876 mention is made of some methods adopted on the survey of base lines and meridians of the special survey to render the surveys as valuable as possible. All lines were chained twice and frequent observations for latitude were taken. All corners on these lines were marked, whether in woods or in prairie, by mounds and posts.

In 1879, a new system for laying out blocks of townships was approved, the first surveys being made in 1880. The size of the block was enlarged to include sixteen townships bounded between two correction lines and two meridians, four ranges apart. As the middle line of the block was a base line, it followed that the north outline would be shorter and the south outline would be longer than a base line, and in projecting the block, the calculated lengths of the north and south outlines were laid off making all the quarter section lengths equal in each case. The township outlines within this block were afterwards run by the township outline surveyor. The order of the survey of the block was left to the discretion of the surveyor.

This new system was introduced to lessen the cost of surveying and is now known as the second system of survey. The methods of establishing the lengths and directions of the lines were also described. All lines were to be measured twice, having two sets of chainmen using steel band chains, the leading one to be a standard Gunter's chain, and the following one, a one hundred feet chain. The limits allowed in the difference of the two chainings of a section length were three links in prairie or five links in woods and brush. The surveyor must have a standard measure with which the field chains were to be frequently compared. The correction of one half a link to the mile for each ten degrees (Fahrenheit) variation from 60° was to be allowed for. The rear chainman should be provided with a clinometer for ascertaining slopes and the measurement corrected from the table of slope corrections. The instrument to be used was a reiteration transit theodolite having a six inch horizontal circle reading, by three verniers, to either ten seconds or 0°.002 of arc, a three inch vertical circle with two verniers reading to one minute or 0°.01. The telescope should be supplied with eye-pieces of different powers, one high power being for star work.

The astronomical meridian should be obtained by observation of Polaris during daylight. For reducing the observations a sidereal watch was necessary.

In producing the line the surveyor should give forward sights with circle right and circle left and then repeat the operation once.

In 1880, the Department of Indian Affairs was organized and from that time Indian reserves have been laid out by surveyors of that Department.

The second edition of the Manual of Survey, prepared under the direction of Lindsay Russell, Surveyor General, by Mr. E. Deville, D.T.S., was issued in 1881 and described what we now know as the third system of survey. Road allowances were reduced to one chain in width and one half the chord road allowances were abolished. This served the two fold purpose of lessening the cost of the survey and of leaving more land for cultivation.

In the numbering of the townships, mention was made of townships south of the forty-ninth parallel. These were east of Lake of the Woods and are now within the boundaries of Ontario.

The boundaries of the first and second systems of survey were defined and it was provided that the road allowance between two different systems should be one chain and a half wide and posted on both sides of the road.

Whenever a gore occurred between two adjoining townships or ranges surveyed according to different systems, and when the number of the fractional township or range was the same as the one surveyed formerly it should have the letter "A" added to distinguish it.

A surveyor going through Winnipeg or any other point where a standard section had been established was instructed to train his chainmen on that known line until they could chain accurately. Chainmen were to be sworn and their oaths filed with the returns of survey. No mention was made of the front and rear chainmen interchanging places after every tally. Lines through woods were to be well opened out and those established as boundaries were to be blazed.

In the new system of survey the Manual provided for the laying out of blocks of sixteen townships each, bounded by base lines and by meridian lines four ranges apart. In surveying the meridian outlines the closing errors on the correction line were to be allowed for equally in the quarter sections adjoining the correction line. In order to correct for any closing error and to prevent the accumulation of errors the surveyor might deviate the two base lines of the next block equally and in opposite directions so as to effect the required correction at the end of four ranges, provided, however, that such deviation should not be greater than two minutes of arc, except in closing on an initial meridian. The jog on a correction line was to be left as found unless it showed an error of one chain and a half or over in the survey of the block, in which case the block was to be resurveyed to locate the error. The limit allowed in the north and south closing was also one chain and a half.

Certain changes were made in the monuments to be established at corners. Bearing trees were to be marked with a knife or scribing iron, while the distance and bearing from the corner to the tree were to be marked with red chalk. Wooden posts in prairie were to be four feet four inches long, driven twelve inches in the ground, stand two feet and a half in the mound and project ten inches above the mound. Quarter section posts were to be marked with the fraction ¼. Sods and all foreign substances were to be excluded from earth mounds. Pits were to be dug three feet square and eighteen inches deep, their centres being four feet and a half from the centres of the base of the mound. A rope skeleton was recommended to facilitate the speedy marking out of the position of the mound and pits at a corner. In a stony region the mounds might be built of stones, no pits being required. The post which was planted in the centre of a witness mound was to be marked "W. M." with a knife or scribing iron, but the bearing and distance from the post to the corner were to be marked on it with red chalk. The witness mound was built in the form of a cone, the earth required being taken from a circular trench fifteen inches wide. All township corners were marked with iron bars where possible, and these were driven in the same position relative to the mounds as at former block corners. If a township iron post fell in a place where no mound could be erected, a wooden post of the same dimensions as for a section corner and marked "I. B.," was planted one foot from the iron bar on the side where the mound should stand. The corner was also perpetuated by bearing trees or a witness mound. No changes were made in the markings on posts except that posts on the north outline of a township, with the exception of a correction line, were marked on the south west face with the township and range numbers. The letters "W" and "E" were to be marked only for the principal meridian.

A block outline surveyor was required to have a reiteration transit theodolite with a six inch horizontal circle reading by three verniers to 0°.004 and a three inch vertical circle with two verniers reading to 0°.02, the decimal subdivision being used in order to facilitate the taking of a mean of a number of readings of the three verniers. The assistant used a reiteration transit with a four inch horizontal circle reading to minutes or to 0°.01, for use in giving the line to the axemen, for measuring the angles of small triangles, etc. Explicit and minute directions were given for the observations on Polaris, the reference object being, if possible, half a mile from the observer. Surveyors were expected to observe on base line and meridian exterior work every clear day. The methods of obtaining the chronometer error and the value of the striding level were explained. The formula for the reduction of the observations was given then as now:—

$$\tan \text{Az.} = \frac{\tan P \sec \phi \sin t.}{1 - \tan P \tan \phi \cos t.}$$

The observations were to be sent in as recorded in the field. No copy of this record would be accepted. Deflections at township corners on base lines and deflections in the base lines for correcting the bearing were to be made by deflection offsets. Great care was to be exercised in reading the angles of triangles and angles turned off from base lines on meridian exteriors. At the corners of blocks the surveyor was instructed to lay off the approximately correct angle and then to read accurately the angle thus set off, any necessary correction to the bearing of the line being made by means of deflection offsets.

The first set of chainmen was to use a clinometer for measuring the slopes, the second set was to break chain over sloping ground. The two chainings must not differ by more than two links per quarter section in prairie nor three links in wooded country. When the distance across an obstacle was being determined by a triangle it was necessary to have another independent check, either another triangle or a micrometer measurement. If a second triangle was used having the side to be calculated common with the first triangle, it was sufficient to set up the instrument at both ends of this line to check the angles. In a triangulation the angle opposite the base should be at least thirty degrees if possible, and must not be less than fifteen degrees.

Block outline surveyors were expected to send in monthly progress reports accompanied by sketches on the scale of six miles to the inch showing the lines run up to date, the deviations of the base lines, the depth of the quarter sections adjoining correction lines and the lengths of the jogs. By coloured tints the character of the surrounding country was shown. The information concerning the directions and chainages of the lines was to be furnished to any surveyors running township outlines within the block.

Their final returns were to consist of:—

1. A diary for the time the surveyor was employed.

2. A general plan of the survey on a scale of forty chains to the inch, showing all the main topographical features of the country, the surface features being shown in tints as follows:—

Bush—A wash of light green.

Brulé—A wash of light brown.

Swamps—A wash of light yellow with small strokes of green.

3. A copy of the field notes.

4. The original record of observations.

5. The oaths of chainmen.

6. A general report of the survey.

SURVEY OF TOWNSHIP OUTLINES.

The instrument to be used was a transit theodolite with a vertical circle reading at least to minutes, inspected and approved by the head office. The method adopted was to run from the base line north or south as the case might be, a depth of one township, and then run the north or south outline of that township, first by a trial and then by a true line, making all the quarter sections of equal length. The meridian outline was then continued the depth of another township and the trial jog laid out far enough to intersect the meridian line from the opposite direction. The proper angle to turn off for the direction of the jog was given as 90° plus one half the deflection angle for that correction line if turned off from the meridian to the south, or 90° minus one half the deflection angle if turned off from the meridian to the north. The meridian line was then run from the opposite base line in the same manner until it intersected the jog, when the closing error was divided equally between the two quarter sections closing on the correction line. The mean average deviation from theoretical of any twelve mile meridian should not exceed one minute and a half.

In running the correction line only one trial line was run on which temporary marks for both sides of the road allowance were placed. The trial line was run only as far as the township corner on the same side of the correction line as it, but the length of the jog being measured, the lengths of the quarter sections on both sides of the correction line were calculated. The true line connecting the opposite township corners was next run making the quarter sections equal in length, at the same time establishing the corners on the opposite side of the road by moving the temporary posts the proper distance east or west and then measuring north or south the width of the road allowance at that point. This width varied and was calculated from one of the tables in the Appendix.

The direction of the lines might be obtained if necessary by solar observation, directions for which were given very fully in accordance with the formula.

$$\cos \tfrac{1}{2} z = \sqrt{\cos S \cos (S-\triangle) \sec \phi \sec h}.$$

$$\text{Where } S = \frac{h + \phi + \triangle}{2}$$

Monthly reports and progress sketches on the scale of one mile to the inch, showing the character of the country, the lengths of the quarter sections and the inner angles at every township corner, were to be furnished. When the sub-division followed immediately after the outlines were run, this information was to be sent directly to the sub-dividers. The final returns were the same as for block outline surveys with the exception that the book of astronomical observations was not required.

TOWNSHIP SUB-DIVISION.

The bond of a survey contractor was reduced to the estimated amount of the contract.

The subdivider was supplied either by the township outliner or from the head office with a sketch showing the lengths of the quarter sections and the inner angles at every corner of the township.

The instrument used was the same as for township outline surveys and the measurements were to be made with band tapes. The subdivider first carefully measured one or more miles of the township outline to compare his chaining with that of the lines previously run, and to so modify it as to obtain the best agreement with the outlines. He was not to start the meridian lines at right angles to the north or south outlines, but should calculate from the sketch furnished him the proper angle to turn off to strike as near as possible to the post on the other outline. In arriving at or starting from a correction line the length of the adjoining quarter section was to be made proportional to the lengths shown on the outlines. The words "in arriving at" in this clause seem to be contradicted by a later clause which required all distances to be returned as they were measured on the ground. If in running a chord, the trial line struck more than fifty links from the post, the lines involving the error had to be retraced. The opposite chord boundaries of blocks of two sections must be within fifty links of equal length.

All navigable rivers and all lakes of twenty acres or more, together with all islands in them, were to be accurately surveyed.

Both banks of navigable rivers were traversed when the width was so great as to render it necessary for the correct calculation of the land areas of the broken quarter sections.

Settlers' improvements were to be surveyed and statutory declarations obtained.

Monthly reports were to be furnished accompanied by sketches on the scale of one mile to the inch showing the sections surveyed, together with the information and topography.

The final returns in addition to the field notes and plan were to consist of:—

1. A timber report and plan for each township.

2. The oaths of chainmen.

3. A report on settlers' improvements together with statutory declarations.

4. A general report.

Traverse lines were plotted on the blank pages at the back of the field book on a scale of twenty chains to the inch, but if the lake or river was too large to be plotted on a single page, then the plot was made on tracing linen and pasted in the book. The section lines were to be entered in the field book in regular order as follows:—E. 2, E. 11, N. 12, E. 14, E. 23, N. 24, E. 26, E. 35, E, 34, E. 27, N. 23, etc.

The plans were to show the lengths of all quarter section sides. The timber report and plan gave the quality and extent of the timber for lumbering purposes and for settlers' needs. Careful returns and separate reports were to be made of all improvements made by settlers, giving the location, nature and area of the same together with an estimate of their value. When errors or omissions were found in the final returns, they were returned to him for correction.

In 1882, iron posts were substituted for wooden posts at section corners in prairie. They were planted in the centre of the mounds, each post being driven one foot in the ground and projecting two inches above the mound. On the top a square tin plate having the appropriate markings stamped on it was slipped over the post and held on by a nail through the post. The letters N., S., E. and W. were stamped on the tin to indicate its proper position on the post. The same markings were stamped on the tins as were formerly on wooden posts except that they were in figures instead of Roman characters. The iron posts were marked with a cold chisel on the iron itself on the south west face, with the number of the section, or with the letter "R" if on the north side of a correction line, to serve for the identification of the post should the tin disappear.

In this same year two rules were adopted for hastening the completion of the field work and the filing of the final returns. All contractors were to report by a certain date, their presence in the field and the contract of those not so reporting were allotted among those surveyors who were in the field. Secondly, a bonus of fifteen per cent. was added to the accounts of those surveyors who filed their complete final returns before the end of the year.

The third edition of the Manual of Survey issued in 1883 by Lindsay Russell, Surveyor-General, embodied some changes and additions in the system of survey.

In subdividing blocks, the township outline surveyors ran only the meridian exteriors of townships, and the subdividers of townships ran the north and south outlines.

The lands adjoining the Saskatchewan, Battle, Bow, Red-Deer and Belly rivers were laid out in lots twenty chains wide fronting on the river and about one mile deep. These lots were laid out with the side and rear lines parallel to the section lines and usually coinciding with section, quarter section, or quarter quarter section lines, and were numbered from one upwards separately in each township, commencing on the left bank first, then on the right.

It was noted that a blazed line was not recognized as a boundary line by the Dominion Lands Act and therefore it was not necessary that such blazed line be perfectly straight. When running a trial line in the woods, the surveyor might connect it with the posts by short lines making angles of not more than five degrees with the trial line. The blazed line must pass through all the posts.

A road allowance was to be left on the boundaries of all Indian reserves and the surveyor was to run the side of the road adjoining Dominion lands.

A corner between two river lots was established as a section corner with the sides of the post and mound parallel to the side lines of the lot. If a monument defined not only a river lot, but a section or quarter section corner as well, it was built and the post marked without any reference to the river lot.

A witness mound in prairie had an iron post with a tin stamped "W. M." together with the bearing and distance of the site of the true corner from it.

River lot posts were marked on two sides with the numbers of the lots adjoining and on one of the other sides with the township and range numbers.

THE FIELD BOOK.

No index of traverse lines was required. Section lines were to be entered in the notes in the order in which they were run. Road allowances were to be ruled in the proper locations and the position of corner monuments indicated. The depth of loam and kind of sub-soil at corners where pits were dug was to be noted.

SUBDIVISION OF TOWNSHIPS.

The subdivider had first to run the north and south boundaries, if not already run, first by trial and then by true lines. Only one side of a correction line should be run at one time. In closing a meridian line on the north or south boundary of the township, the last quarter section corner was at once established permanently at forty chains and connected by a straight line with the section corner on the outline. If the meridian struck more than fifty links from the corner, the whole meridian must be resurveyed.

The rear line of river lots was to be surveyed and monuments erected at the corners, but no monuments were required on the river front.

When the average width of a navigable river exceeded three chains, both banks were to be traversed. Whenever a marsh was so deep that it could not be forded by men or horses, it was to be traversed and its area deducted from the quarter sections affected, but if it could be forded, it should not be traversed. In making traverses, astronomical bearings and not deflection angles were to be read and on the traverse plot a separate table of the bearings and distances might be shown.

Surveyors were forbidden to make any charge to squatters for receiving their statutory declarations.

In making the plan of a township the surveyor was instructed to show only the lengths of quarter sections which were not exactly forty chains or which were broken by water areas, and only the areas of fractional, irregular or broken quarter sections, all others being considered regular and their areas reckoned as one hundred and sixty acres. The area of every river lot was to be shown. Settlers' improvements and the names of those settlers who made declarations were to be shown on the plan.

In case the returns of survey were not considered sufficiently neat or accurate, they were returned to the surveyor or were made up in the Department and the cost charged to the surveyor's account at the following rates:—

Township plan, first or second system......	$ 8 00
Field book, first or second system.........	13 00
Township plan, third system..............	6 00
Field book, third system.................	10 00

These prices did not include making traverse plots nor copying an excessive amount of traverse notes.

This Manual of Survey also contained extracts from the Dominion Lands Act, 46 Victoria, Chapter 17, with reference to the re-establishment of lost corners as follows:—

1. If a township corner was lost the fact should be reported to the Surveyor General who would send instructions for its re-establishment.

2. If a corner on a township outline was lost, the nearest undisputed corners on the outline were to be joined by a straight line and the quarter sections made equal in length;

3. Except where closing on a correction line when the excess or deficiency was to be left in the quarter section adjoining the correction line.

4. And except where closing on the west outline of a township in the first system of survey where the excess or deficiency was to be left in the westerly quarter section.

5. If a corner on a meridian line was lost, the nearest undisputed corners were to be joined by a straight line and the quarter section lengths made equal;

6. Except where closing on a correction line, when the excess or deficiency was to be left in the quarter section adjoining the correction line.

7. If a quarter section corner on a chord line was lost, the section corners were joined by a straight line and the quarter section lengths made equal;

8. Except on a chord line in the westerly tier of sections in the first system of survey, when the easterly quarter section was to be made exactly forty chains.

In 1884 the survey of travelled trails was begun in accordance with the provisions of the North West Territories Act. Exploratory surveys mainly along the great rivers of the interior were commenced in this same year, as well as the survey of the lands within the Railway Belt of British Columbia, the third system of survey being modified to meet the conditions in that mountainous region. Three acres for roads were added to each quarter section instead of locating the roads along the section lines. This addition was provided for by making each quarter section on the base line forty chains and fifty links and on the meridian, forty chains and twenty-five links. The road allowance between the third and fourth systems was one chain wide. An instrumental traverse was made along the road bed of the Canadian Pacific Railway during the two following years, to establish points of reference from which surveys at different points throughout the belt could be started.

In 1885 the bonus addition of 15 per cent. to surveyors' accounts for filing their returns of survey before the end of the year was discontinued. In 1886 it was decided to dispense with mounds in the grazing country as it was found that cattle tramped them down, thus filling up the pits. The earth from the pits was in future to be scattered, and the iron post was driven into the ground to within ten inches of the top.

In this year an attempt was made to introduce photography on the surveys, a limited number of surveyors being provided with cameras. Topographical surveys were commenced in the Railway Belt during the year.

In 1887, posts and mounds defining river lots were removed from many townships except where such lots were found occupied. No further river lots were surveyed in districts where the system of survey was far enough advanced to permit of the land being sub-divided into regular sections.

In 1889 a start was made on a triangulation survey of the Railway Belt.

In this year also the tin on iron posts was discarded, a slightly larger post being used and the marking made on the iron with a file or cold chisel. It was recommended by the inspector of surveys that posts and mounds should be made at all corners in woods, but this was not completely carried out until several years later, although partly so in the next year, in the new Manual of Survey.

The preliminary fourth edition of the Manual of Survey was issued in 1890, by the present Surveyor-General, Dr. Deville, and embodied several modifications to the system with reference to the sub-division of townships of which it dealt almost completely.

The exception was noted of running the township meridians southerly from the second base line to the first correction line, making all the quarter section lengths forty chains and then running south to the International Boundary after laying off the theoretical jog, and leaving the surplus or deficiency in the quarter sections adjoining the boundary.

In the case of a fractional range adjoining an initial meridian, when the initial meridian intersected the jog, the last quarter section on the meridian township outline, surveyed from the south, was made of the same depth as that on the next meridian township outline on the east.

In running chord lines the quarter section corner might be offset to correct position.

CHANGES IN MONUMENTS.

Iron posts and mounds were built at township and section corners in the woods, but no mound was made at a quarter section corner in the woods. In prairie, if wood could not be obtained within three miles, the post might be omitted at the quarter section corner. In wooded country one of the pits might be omitted when it was impracticable to make it on account of large trees or other obstacle.

Whenever stones were readily procurable, the mounds must be made of stones. A witness trench should be twenty-four inches wide and twelve inches deep. The iron post stood in the centre of the witness trench or at the point of the base of the mound nearest to the corner, and all witness monuments were to be built at the nearest suitable point on the surveyed line and the bearing indicated by one of the letters "N., S., E. or W." No instructions were given for marking bearing trees.

All corners on the boundaries of Indian reserves, settlements, group lots, or generally, that defined lands on only one side of the road, were to be built in a similar manner to those on a correction line, or line between two systems of survey.

Iron posts at corners governing lands on both sides of the line were marked on the southwest face with the number of the section, the north east angle of which the post indicated, followed by the numbers of the township and the range. Posts on correction lines were marked with the number of the section on the west face and with the township and range numbers on the north or south side according as the post was north or south of the correction line. Posts on east and west lines dividing two systems of survey were marked in the same manner as posts on correction lines. Posts on north and south lines dividing two systems of survey were marked on their south face with the number of the section, the north boundary of which they indicated, and with the numbers of the township and the range on their east or west face according as the posts were on the east or west sides of the road allowance. All marks on iron posts were to be made with a cold chisel and in Roman characters.

When a correction line had to be deflected across the last fractional range in order to close on an initial meridian, the north or the south side, as the case might be, of the correction line was deflected in such a way as to leave the full width of one chain for the road. Boundaries of Indian reserves or other previous surveys were to be retraced when the areas of the quarter sections adjoining could not be calculated without such survey. The only islands to be traversed were those of twenty acres or more in extent. The use of the micrometer, if of an approved pattern, was allowed for traversing, provided the closing error did not exceed one chain in one hundred. The actual water line at the time of survey was to be traversed and the areas calculated accordingly. In making the traverse, the points determined should be such that any one point was within ten chains of the next.

The Field Book.

Where a monument at a corner was established by a previous survey, such was to be stated. The true course of each line referred to the meridian of its initial point was to be shown. It was no longer sufficient to enter a course as north, for instance, when the direction, although northerly, was not exactly north. The distance which a meridian line struck east or west of the corner on a township outline was to be entered in the notes. No timber plan was required.

The fourth edition of the Manual of Survey was issued in 1892, and amended some of the former clauses. In outlining blocks of the first system the base line was to be run first in every case. The limit of error of an average deviation of one and a half minutes from theoretical in running township outlines was not mentioned.

The extension of the Dominion Lands system to the Railway Belt necessitated a description of the fourth and fifth systems of survey.

The longitudes of the initial meridians were given. It is interesting just here to mention how the different meridians were established. The principal meridian was commenced in no particular longitude, but in 1874-75 its longitude was determined by measurement from West Lynne, the longitude of which had been determined by telegraph from Chicago. The position of the second meridian was established in longitude 102° (very nearly) by a triangulation from the principal meridian. The third, fourth and fifth meridians and the sixth in Alberta were established by chain measurements principally along base lines.

No road allowance was to be left between the fourth and fifth systems of survey, but a double row of posts was planted on the line dividing the two systems to govern on each side respectively.

In all systems the quarter section east of an initial meridian contained all the deficiency. In closing a meridian line on the north or south outline of a township, the last section corner was established permanently and joined by a straight line with the corner on the outline. The angle between a section line and any intersecting traverse line was to be shown in the notes. Attention was drawn to the necessity for devoting care and attention to the preparation of general reports, to give the natural resources of the country, its industries and its suitability therefor.

Township outliners were to observe for bearings the same as block outliners if possible, but if their instruments were not powerful enough, sun observations were sufficiently accurate. Their progress sketches were to be on a scale of one half mile to the inch and their final returns were the same as for block outliners.

In 1894 irrigation surveys were inaugurated. A line of levels was run along township lines for finding the slope of the country.

The fifth edition of the Manual of Survey was issued in 1903 and contained quite a number of changes and additions.

Instructions were included for the survey of settlements, group lots, and townsites, and these instructions have not materially changed since.

A radical change was made in recording the bearings in that all the bearings in a township were to be referred to the astronomical meridian through the centre of the township, and instructions for taking the astronomical observations to obtain this result were given.

In surveys other than township sub-divisions, the bearings were all to be referred to a single meridian unless the survey extended over such a distance in longitude as to make this inconvenient. The survey should then be divided into several portions, each with a separate meridian.

Measurements in feet were allowed in the survey of a townsite. Lines over sloping ground might be measured either by breaking chain or by the use of the clinometer. In the case of a triangulation all three angles were to be measured.

Blazes on boundary lines were not to be omitted where there were trees more than two inches in diameter within fifty links from the line. When the monuments on a meridian line closing on a corner on a township outline were offset from a trial line, blazes were omitted from the last portion of the trial line, the oblique line to the corner being blazed instead.

In running across a block from one base line to the next, the surveyor of township outlines was to observe at least once on every line across the block, and was requested to plant firmly and carefully his instrumental stations near township corners so that the sub-divider might readily obtain the correct bearing for starting his lines.

Ties were to be made to the corners of any group lot, mineral claim, or other parcel of land previously surveyed, with the monuments of trails and with properly identified points of railway surveys. At least one observation was to be taken in each township and a record of the observations and their calculations were to be furnished in the field notes. If the weather was unfavourable for observing, the sub-division might be commenced with an assumed meridian, correcting the bearings, if necessary, after an observation was obtained.

The survey should be made with reasonable care. No survey would be accepted in which the number of errors denoted carelessness even though the closing of each block was within the limit of error allowable. No surveys of regular sub-division lines were to be made without instructions from the Surveyor-General.

TRAVERSES.

The bank of a lake or river was defined as the line where vegetation ceased. The rights of riparian owners to future additions to their land which might result from gradual alluvion or dereliction were recognized, together with the converse, that lands gradually encroached upon cease to belong to the former owners to the extent of the encroachment. On the other hand sudden and sensible additions to or subtractions from lands arising from similar causes would not cause any change in ownership. It therefore followed that the line to be traversed was the bank of a lake or navigable stream, and the middle line of an unnavigable stream, middle being used in the sense of following the centre of the main body of water flowing in the channel, except in the case of an unnavigable stream over three chains in width when both banks were to be traversed and the area deducted, but islands less than twenty acres in extent were to be included in the areas of the adjoining fractional legal subdivisions.

The edge of a marsh was not admissible as a boundary, but if a parcel of land extended to such a feature the boundary was to be defined by one or more straight lines. Shallow lakes and marshes, and marshes producing hay were not to be traversed. Those marshes of which the edge varied ten chains or more according to the season, were to be dealt with by selecting the legal sub-divisions which more nearly included the land suitable for farming. The points of the bank or line traversed should not be more than five chains apart on surveys other than township sub-division. Offsets were not to be greater than four chains on township sub-division work nor two chains on other surveys. Traverses on other than township work for ascertaining water areas must be chained. Lakes were to be named or designated by a number. It was not necessary to show the angles between traverse and section lines in the field book. A quarter section was considered sufficiently surveyed for disposal if two of its corners were indicated on the ground. A quarter section rendered fractional by water should have its area ascertained.

MONUMENTS.

If stones were readily available a stone mound might be built, but pits were to be dug also if possible to make them. A mound and pits of the same dimensions as for a section corner were to be marked at all quarter section corners in the woods where it was possible to make them, the wooden post standing in the same position with regard to the mound as would an iron post. A monument was not to be placed on a road allowance, public highway nor travelled trail. The post for a witness mound was planted in the middle of the trench on the side nearest to the corner. Corners of group and settlement lots were to be marked the same as section corners. If iron posts were not available, wooden ones might be used. Such a post would be three feet long, squared to three inches on all four faces and driven eighteen inches into the ground in the same position as an iron post would have occupied. Monuments on the limits of a highway were the same as at section corners on correction lines. If they were made on both limits of the road, iron posts were used on one side and wooden posts, similar to those used for group or settlement lots, on the other side. No corner was to be marked by more than one monument. One face of the iron post was stamped by the makers with a crown and no marking was to be made on that face.

Technical definitions were given for a resurvey, a retracement survey, a restoration survey, an obliterated monument and a lost monument. A surveyor was to report any errors of survey or any duplicate monuments which he found. If the subdivider of a township found an error of three chains or more in the position of a monument on the outline of the township he should resurvey or retrace the outline. In retracing a line all obliterated corners were to be restored. Lost monuments were to be re-established if the lands affected were vacant or if the owners gave their consent in writing. If the line was resurveyed the positions of the corners destroyed was to be noted and entered in the field book.

Returns of Survey.

No plans were required from township subdividers, these being made in the office. These plans no longer showed settlers' improvements or names, nor the lengths of broken quarter sections. Care was to be exercised in showing in the field notes the topography on both sides of the line. The condition of preservation of all monuments found was to be noted, also whether they were restored or not. A general report on the characteristics of each township was to be given.

No plans were required from surveyors of block or township outlines.

Clerical errors in the notes, if not too numerous, would be corrected in the head office upon authority granted by the surveyor being received.

A surveyor to be eligible for day work or for survey contract must own at least a standard measure, a sixty-six foot steel band, a transit in good order and of an approved pattern, with horizontal circle at least four inches in diameter and reading to minutes or less. A block outline surveyor must have in addition a six inch transit, a sideral watch, and a one hundred feet band.

A surveyor was at liberty to employ any suitable method in observing for azimuth provided the record of the observation was such as to afford an opportunity of checking the computation. This barred the solar compass. The method recommended in the sub-division of townships was by observation of Polaris early in the forenoon or late in the afternoon.

The Dominion Lands Act was modified in the fourth system of survey in that the straight line joining township corners on the south side of correction lines govern the alignment of posts.

The sixth edition of the Manual of Survey was issued in 1905, but this edition contained only a few amended clauses.

The subdivider of a township was instructed to measure carefully a mile of the township outline to compare his chaining with that of the lines previously run, but he was to make no change in his own chain. If in running one of the limits of a correction line, the other limit of which had been previously surveyed, it was found that the road allowance was less than eighty links wide, the line should be deflected at a section or quarter section corner so as to leave a road allowance of normal width, unless the error in the closings could be corrected by resurveying the meridian lines and adjusting the closings correctly.

Should a meridian section line strike more than fifty links, but less than one chain from the corner on the township outline, it must be resurveyed as a true line across the last section. Should the line strike more than one chain, but less than one chain and fifty links from the corner, it must be resurveyed across the two last sections and so on, adding one more section for every increase of fifty links in the closing error. If the trial line of a chord struck more than fifty links from the corner, it must be resurveyed.

A road allowance was left on the boundaries of an Indian reserve if it was required to make every quarter section accessible by a road or to give a reasonably direct route from one part of the township to another. If no road allowance was left, all surveyed lines closing on the reserve were posted on the reserve limit.

It was no longer considered necessary that the opposite boundaries of sections should be within fifty links of equal length, but every block of two sections must close within fifty links, except where closing on an outline previously surveyed, when the limit of error was one chain and fifty links. The plot of a traverse between two traverse hubs must close within fifty links.

A quarter section corner falling in a lake or marsh not over three feet deep was to be marked by a wooden post not less than five inches in diameter and long enough to be driven three feet into the ground and show six inches above the water.

A surveyor was instructed to restore every monument of a previous survey struck by his lines when such monument was not in good condition. Where any section corners had been originally marked by wooden posts, iron ones should be substituted. If a subdivider found a corner on the meridian outline more than one chain and fifty links from the place where it should be, he might resurvey or retrace such outline. If a resurvey was made it should be continued to the correction line. No statutory declarations were to be taken on resurveys, retracements or restoration surveys. Distances measured by stadia or micrometer must not exceed one-half a mile.

Progress sketches on the forms supplied for township subdivision, were to show the bearings and lengths of all section lines surveyed, and all quarter sections rendered fractional by a traversed body of water were to be designated by the letter "F."

Traverses were to be plotted on tracing linen, but were not to be pasted in the field book.

Astronomical field tables in convenient form were supplied to surveyors, which greatly simplified the taking of observations.

In 1906 a few clauses were slightly amended.

In dealing with marshes of which the edge varied ten chains or more, the surveyor should indicate in his notes the quarter section lines which in his opinion separated the good and worthless land.

In 1908 a change was authorized which will tend to greatly increase the permanency and value of the survey. This was the substitution of iron posts, similar to those at section corners, for wooden posts at quarter section corners. An additional aid towards locating one's position on the ground was given by marking witness posts, on the face away from the direction of the true corner, with the number of the section which would have been marked on the post had it been placed at the true corner. An attempt was also made towards securing additional information concerning the elevation of the country by requiring surveyors to measure and show in their notes the differences of elevation as recorded by aneroid barometers.

In this same year the Dominion Lands Surveys Act was passed, 7-8 Edward VII, Chapter 21, it being revised and separated from the Dominion Lands Act. It provided that in the re-establishment of lost corners, the lengths of quarter sections should be made proportional to the lengths shown on the official plan of the township. It provided for the correction of errors in the original survey if the land was vacant; if, the land being occupied but not patented, the error in the position of the monument was five chains or more; or if the occupant or owner gave his consent in writing. It also gave the Minister of the Interior authority to order a resurvey on receipt of a petition from the owners or occupants of lands in a township, representing that the monuments of the original survey have disappeared and cannot be found.

A large number of these corrections and resurveys has already been made and doubtless many more will be required. The surveyor on this work requires to be very tactful in his methods of approaching the resident owners and settlers. He is furnished from head office with the standing of all the lands affected, together with the names of owners and homesteaders as far as such can be obtained from the records of the Department, and he is instructed to be very careful not to do anything which will lead to trouble between the settlers and the Department. Often a "bit of blarney" will help him to overcome some person's objections to the moving of his corner or the re-establishment of it at a place where it cuts off some land which he always thought was his. Or perhaps the prestige of a Government surveyor or a hearty invitation to come over to the camp at night and listen to the gramophone or have a little jollification with the boys, will enable the surveyor to obtain the necessary signature to the petition without which the error could not be rectified.

In 1909 the size of base and meridian line survey parties was increased by the addition of a leveller and a rodman for the purpose of obtaining an accurate profile map of the line. This information is being collected and joined up in the Calgary office of this Department, under the direction of Mr. J. N. Wallace, D.L.S., and it should prove of very great value when the questions of new railway locations, drainage, irrigation and water power projects are being considered.

In 1910, the seventh edition of the Manual of Survey was issued to Dominion Land Surveyors and it contained quite a number of amplifications of former clauses.

In the case of a fractional township, the bearings were to be referred to the astronomical meridian through the point which would be the centre if the township were not fractional. The number of blazed trees in woods was specified by requiring that they should not be more than seventy-five links apart.

In surveying either limit of a correction line, a connection was to be made with the township corner on the opposite boundary and recorded in the field notes.

Some surveyors having found difficulty in locating the proper line to survey in the traverse of lakes and rivers, the bank of such was defined as the line where vegetation ceased or where the character of the vegetation and soil changed. Reference was made to the Irrigation Act for the provinces of Saskatchewan and Alberta and for the North West Territories, except Franklin, Mackenzie and Ungava, which provides that the Crown shall not grant any exclusive property or right in the land forming the bed or shore of any lake, river, stream, or other body of water. Therefore where this act applies both banks of all rivers mentioned in the instructions must be traversed. An unnavigable stream averaging more than one chain, but not more than three chains is surveyed from a single traverse line. An unnavigable stream averaging less than one chain is not traversed, but its area is supposed to be estimated and deducted from the area of the sub-division, but I cannot find that this has ever been done as yet. In both of these two latter cases the areas of islands may be included in the adjoining sub-divisions. Islands less than twenty acres in extent are to be located by offsets to their extremities and their widths measured. Where the Irrigation Act does not apply, the middle of all unnavigable streams is the boundary between the adjoining lands, but if such a river is three chains or over wide both banks shall be traversed and the areas deducted.

In dealing with marshes and lakes of which the edges vary ten chains or more, it was found that the most suitable way for the surveyor to show the legal subdivisions rendered worthless for farming was by means of a sketch, so this was required.

As a deterrent to the wilful removal of iron posts, they were stamped by the makers on the Crown face with the inscription "Penalty for Removal, Seven years Imprisonment."

As an aid in locating the true corner of a township or section in bush country where such corner falls in a marsh or slough not over three feet deep, necessitating the erection of a witness monument more than five chains distant, a post of the most durable wood obtainable in the vicinity, squared at the top and marked in the same manner as prescribed for iron posts at section corners, was firmly driven at the true corner.

As an additional means of perpetuating a corner in the woods, bearing trees might be marked . The letters "B. T." and the distance to the corner were marked on the blaze with a knife. The bearing from the corner to the tree was recorded and might be marked on the blaze with red chalk or paint.

Although no mounds were to be built in prairie, yet small openings of two chains or less in extent in continuous bush country were not to be classed as prairie, but on the other hand, mounds were to be built in small wooded bluffs, two chains or more in extent, in prairie. On a contract survey the field notes should show every opening in the woods of half a chain or more. In order that the nature of the soil might be properly described, definitions of soils were given in the Manual.

In surveys other than township outlines or subdivision, the field notes must show the markings made or found on all posts. For surveys in the Railway Belt, traverses were to be plotted on a scale of fifteen chains to an inch.

In surveying block outlines, the clinometer was to be used on both chainings and observations were to be taken every four miles or thereabouts. The instrument used on these surveys, as supplied by the Department, is graduated to five minutes and read by means of two microscopes to five seconds of arc. The surveyor was to employ an explorer who was expected to ascertain and plot in approximately correct position the topography for twelve miles on either side of the surveyed line.

In 1911 contractors were required to furnish, in addition to the other returns of survey, a diary showing for every day on which any of the survey operations were carried out, the work done by himself and his assistants. If not engaged for every day on the actual survey himself, he should state for each such day the reason of his absence.

The eighth or present edition of the Manual of Survey, issued in 1913, need not be dwelt upon at any length. There are, however, a few amendments which may be just mentioned in closing.

The longitude of the principal meridian is not the same as given in previous Manuals of Survey as its position has been more accurately determined.

Trees must be blazed at least at every chain on either side of the line in woods.

If a jog on a correction line is short, it may be turned off at ninety degrees from either meridian, but if it is forty chains or more in length, account should be taken of the convergence of meridians. When surveying a correction line, connections must be made with all monuments on the other side of the line, and if it is found that the road allowance at any point differs from the normal width by twenty links or more, a correction shall be made. If the irregularity is found to be due to an error of more than one chain and a half in the position of one of the adjacent township corners, the surveyor may resurvey the meridian outline provided the lands affected are vacant, or if occupied, the occupants give their consent in writing. If, however, the error be less than one chain and a half, or if the correction cannot be made, the surveyor shall deflect his line at some section or quarter section corner so as to leave a road allowance of normal width. When, in closing on an initial meridian, one side of a correction line has to be deflected so as to leave a road allowance of normal width, such point of deflection is marked by a monument similar to that at a section or quarter section corner.

In sub-dividing townships all lakes over ten acres in extent and any islands containing not less than five acres are to be surveyed.

Islands less than five acres are to be located by offsets to their extremities and their widths measured. Any river requiring to be surveyed, is to be traversed whether mentioned in the instructions or not. In dealing with lakes of which the edges vary ten chains or more, the useful land is to be shown on the sketch by legal sub-divisions and quarter legal sub-divisions. For further information re stadia surveys of water areas, which surveys were inaugurated in 1913, reference may be made to the excellent paper on this subject by Mr. R. Neelands, D.L.S., which follows this afternoon.

A few changes are made in the character of the monuments. Where a stone mound is built, pits are not required, and if the country is rocky so that the post cannot be driven, the stone mound is built around the post. If a quarter section corner falls in a position unfavourable for building a monument, a witness monument is to be established in the same manner as for a section corner provided it is necessary to do so in order that at least two of the corners of the adjacent quarter sections shall be marked on the ground.

In retracing a line, monuments found in erroneous position are not to be restored.

In order to have a greater uniformity in the final returns of surveys, definitions are given for swamp, marsh, muskeg, bog, pond and slough.

Traverses may be plotted on any scale not less than twenty chains to an inch.

This brings us to the present day, but one or two remarks may not be out of place. You will have noticed that all the Manuals of Survey provide for the survey of blocks of townships, but in actual practice this has not been done to any extent since the early years. As a matter of expediency rather than as a better method of survey, the base lines have been run from one initial meridian to the next without stopping to lay off the blocks. Notwithstanding the precautions taken on the production of the base line, there is no check from one initial meridian to the next and it very rarely if ever happens that the line strikes the post.

When one considers the vastness of the area surveyed and the often meagerness of the appropriations with which to carry on the work, the accuracy and permanency of the surveys performed pay no mean tribute to the abilities of the men who have occupied the position of Surveyor General, nor to the faithful, presevering performance of duty of the many Dominion Land Surveyors who have been in immediate charge of the field operations.

Dr. Klotz: Mr. Chairman, I have very much pleasure in expressing my appreciation of the manner in which Mr. Dennis has presented his paper. It is now forty years since our system of surveys was established. Mr. Dennis might have made a statement of the source of our survey system. It was copied from the system of the United States. They had a system of townships before we had although they were numbered somewhat differently. He told us that originally mounds were built at the section corners. Why the mounds were abandoned was that in the early days, when I first went out there, the buffalo were still roaming over the plains and they took great delight in pawing the mounds and throwing the earth on their backs. They not only destroyed the mounds but filled up the pits. That is the reason the mounds were abandoned and the pits only were dug, the earth being thrown away. Mr. Dennis spoke of carrying standard chains. In 1881 I was instructed to put down a standard. We got three monuments at Rat Portage, now Kenora, for a two and a half mile base line, one for testing chains and the other over rough ground for training the chain men. I think in 1880 a return was ordered of the nature of the soil. I had made returns showing the nature of the soil because I thought it so obvious to make a report on the nature of the soil in all our pits. The solar compass was referred to. That proved a failure because the sun would not shine when we wanted it. It took a long time to get a proper method. I suppose the method now followed will require little change, no matter how long our Northwest surveys continue. Reference was made to the tins we had in 1885. The Indians took them off and wore them as ornaments on their heads. Mr. Dennis might have mentioned why the survey of the Nelson river was made in 1884. The reason was that at that time the Hudson Bay railway was first spoken of seriously and an expedition was sent by sea, under Captain Gordon, with the steamer Neptune up to Hudson Bay, to see about the ice, and I was given the survey of the Nelson river in connection with the Hudson Bay railway to see what the country was like and whether the Hudson straits were fit for navigation. I think Mr. Dennis is a year out in his remarks about British Columbia. He said 1884; that was 1885. British Columbia entered the Confederation in 1871, and the consideration was that we were to build a railway. They had no money to give us and gave us land, twenty miles on each side of the railway that was to be built, so when the railway was just about being finished in 1885 the Dominion Government had a survey made of the railway as a base line. So in 1885 Mr. Ogilvie started the survey of the railway and I had charge of the astronomical work. A very accurate survey was made of the railway as a base line. It has given me very great pleasure to be here and to hear this excellent sketch of the surveys in the Northwest.

Mr. Brownlee: I have much pleasure in seconding the motion. The iron posts were used by the Indians as grills, to grill stakes. An engineer on the C. P. R. had complained about not being able to pick up any survey points on the prairie because the monuments were being destroyed and he could not make any ties. Finally he complained to an official of the Department in the West. At the time the official did not pay much attention. The engineer made a second complaint and finally he turned it into a joke; he said he did not care so much about them taking away the posts as he did about them dumping them in the holes afterwards. That got to Ottawa and got into the hands of the Government here. Both men are alive to-day. I am very much pleased with this paper, it is a splendid history and to us old timers it is like living over again to have an able young man like Mr. Dennis to bring us up to date and rejuvenate and revive these old memories of the survey. I had the pleasure of going on the survey in 1879 and I have been there ever since. I have gone West and North and I suppose that I will wind up in the Artic ocean somewhere.

Motion agreed to.

STADIA SURVEYS.

Rupert Neelands, D.L.S.

In the first subdivision of the western townships, lakes smaller than twenty acres were not traversed, and marshy lakes with a shore line subject to variations of ten chains or more were dealt with by showing the legal subdivisions rendered worthless for farming.

Many changes in the size and character of the lakes in the West occurred from year to year, due to periodic variations in the climate, the cultivation of the ground, the clearing off of bush, and the diversion of the flow of springs and creeks. Many so-called lakes were merely shallow depressions filled with surface water, and these dried up wholly or in part. Others increased in size and depth, lakes of two hundred acres and upwards being found where at the time of the original survey there were only a few small ponds. In other lakes an increase in area due to the attrition of the bank was accompanied by a corresponding decrease in depth. In some cases marshy sloughs became small lakes, and open lakes became hay marshes.

As the land grew more valuable and the rate of taxation increased, many complaints were made by settlers who, having from five to fifty acres of water on their homesteads, were taxed for the full one hundred and sixty acres shown in their patent. Others desired to secure patents to land formed by the drying up of lakes, or to land formerly shown as being included in marshes worthless for farming. As patents were secured and sales of land became common, the presence of a body or bodies of water of unknown area hindered the sale of the land on which they were located.

To ascertain the area of these hitherto unsurveyed lakes, to revise former surveys where there had been a change in the outlines of the lakes or rivers, or in the character of the lakes, and to obtain this information quickly and at a moderate cost, is the purpose of the stadia surveys now in their second season.

The extent of the work of the stadia surveyors is a complete investigation of all bodies of water in the township. All rivers of one chain in width and upwards, all permanent lakes of five acres in area and upwards, and all islands are surveyed. All sloughs, marshes, bogs and muskegs are investigated, reported on and if necessary, surveyed. When in such investigation it is found that a section or quarter section corner formerly left unmarked because of water, is now on dry land, the proper monument is erected at such corner and the witness monument, if any, is destroyed. A chain is used in measuring distances instead of a stadia rod in any resurveys necessary in this connection. The general condition of the monuments in the township is investigated and reported on, and if a resurvey is considered necessary, a petition for it is circulated among the settlers for their signatures if such resurvey is desired by them. Observations are taken in each township for magnetic declination.

Any changes or inaccuracies in the topography of the township, as shown on the original township plan, such as the correctness of the descriptive note, the diversion or disuse of old trails or the drying up or diversion of creeks are noted for correction. The progress and condition of the settlers and the resources of the township are also noted.

The personnel of a stadia survey party consists of, in addition to the surveyor, an articled pupil, two rodmen and a cook. For transport, two teams with light wagons and a collapsible canvas boat are provided. In open prairie townships one wagon may profitably be exchanged for a democrat. Both oars and paddles are provided for the canvas boat. Oars are generally found more satisfactory, as these boats, presenting a large surface to the wind and riding light on the water, are hard to manage with one man only, paddling, if there is any wind. The canvas boat if in use every day, and on lakes the most of which are alkaline, will not last through one season without the exercise of considerable care and much repairing. Holes are closed with patches of duck, the seams being rubbed with wax. If the lakes or rivers on which the boat is being used are rocky and gravelly, the keel should be protected with patches of duck or tin from the first, as this part is difficult to repair and make water-tight once it is worn through, as it soon will be if not protected.

In reedy lakes it is difficult to use a convas boat, and time will be saved by taking soundings by wading if the water is not too deep and the bottom not too soft. The water in lakes completely covered with reeds is seldom over five feet deep.

The stadia traverse is commenced from a section or quarter section corner, the transit being set up to read the bearing of the meridian or chord shown on the township plan. If the bearing cannot be obtained from the section lines, the instrument is oriented by means of the compass, the azimuth of magnetic north having been previously ascertained by the surveyor. When the compass is used to orient the instrument, an astronomical observation, either solar or stellar, is taken when the weather is favourable. If an observation is not taken the traverse is continued until it closes upon another section or quarter section corner.

The needles supplied are sensitive and accurate, and on the prairie it is seldom that the compass bearing differs by more than two or three minutes from the bearing by observation, unless there is local attraction such as wire fences or telephone wires.

In any case, as many ties as possible are made to adjacent monuments, and a tie must be made in at least every three miles.

In producing the traverse towards the lake, it is important that the stations should be carefully located. The majority of the lakes in the western townships can be traversed from one station if the lake is carefully approached and the final station well placed. Economy of stations can only be practised in the approach to the lake if the topography of the surrounding country is well understood. In Northern Saskatchewan and Alberta, lakes generally lie in chains or groups and here the selection of the stations so that no lakes may be missed, and no time lost, is a more difficult matter. Unless the front rodman is an unusually good topographer, it is best that the surveyor should reconnoiter the ground and lay out the stations himself. A general reconnaisance before the close of the day's work of the ground over which it is proposed to run the next day's traverse, should be made if possible, in order to determine the amount of water and the best direction for running the traverse, taking into consideration the location of ridges and ravines, and in timber, of clearings and openings in the bush, and the direction of old logging roads and trails, or any other natural advantages that will save cutting.

In no other way can so much time be saved or lost in stadia traversing as in the placing of the traverse stations. The rear rodman gives backsights at the instrument stations. He also looks after the horses, and if the nature of the country permits, brings them up with him when he goes ahead. It is also his duty to take the necessary soundings, either from the canvas boat, with a lead and plumb-line, or in the case of shallow lakes, by wading out with a graduated staff. His stadia rod should not be used in either of these cases for taking soundings. In the case of large lakes, he may help the front rodman by giving side shots as he advances towards the transit, or if the lake is traversed from one station, he may proceed around it in the opposite direction to that taken by the front rodman. On some occasions, too, he may go ahead and put in the next station while the front rodman is completing the traverse of the outline of the lake. The two rodmen, if of equal intelligence, may thus be allowed to alternate in their positions. The rear rodman, while driving the team, may also investigate the surrounding country for more lakes. In this case it is of course necessary that he should be a thoroughly reliable man, and a fair topographer.

Any of the standard D. L. S. transits equipped with stadia wires may be used on the stadia surveys. Owing to the constant turning on the plate and axis, this part of the transit needs to be strong, close-fitting, and easy to turn, and there should be no eccentricity. Much depends on the vertical circle holding its adjustment and its arrangement should be the best possible. The transits are tested in the Surveys Laboratory each winter, and the proper corrections to the stadia intervals determined. The corrections for each chain of reading from one chain to forty chains for the half interval are then printed on cards for the use of surveyors in the field. While the conditions under which the stadia intervals are determined are rather different from the conditions in the field, any loss of accuracy in this respect is likely compensated for by the extra accuracy with which the determinations are made. Changes in the wire interval result from radical changes in the climate or seasons as well as from physical changes in the wires themselves. Intervals should be tested every few months on a carefully measured base.

The standard stadia rod has been improved by having the hinges strengthened and by having a metal strap placed at the back. The level bubble, too, has been much improved and the colour used in graduating the rod has been brightened. The rods are fourteen feet long, and are graduated to read in chains and tens of links, a total distance of forty-two chains, each group of ten being a different colour.

In reading a rod the chains and tens of links are counted and the fraction of ten links estimated. All the wires are read for precision and accuracy. The whole reading, being twice as accurate as the half readings, is always read up to distances of twenty chains, if possible. The slope of ground, and intervening reeds, grass, branches and leaves of trees often prevent the reading of the whole interval for distances less than twenty chains. The upper and lower interval reading should agree when reduced, and their sum should be equal to the reading with the whole interval. Where there is a difference between the upper and lower interval readings, the upper is preferable as there is less interference from refraction which is greatest in the strata of air next to the ground, traversed by the lower line of sight, than it is in the strata a few feet above traversed by the upper line of sight. This causes a difference between the actual rod reading to a reading in a perfectly homogenous atmosphere. The reading varies during the day, the rod intercept being least at mid-day and greatest in the morning and evening.

The stadia field books are specially prepared for the work. At the top of the left hand page, blanks are left for the date of the survey, and for giving the location of the lake. The remainder of the page is ruled into columns. In the first column is entered the designation of the point sighted on, numbers being used for stations and letters for side shots. The stadia interval read on the rod is put in the second column, the bearing in the third, the vertical angle in the fourth, and in the fifth column the corrected distances are entered. The rest of the page is left for remarks. The right hand page is ruled in cross section on a scale of ten chains to an inch, and is used for making sketches or rough plots of the body of water being traversed. The column of corrected distances is entered up at night, if there is not sufficient time in the field. Corrections for the stadia intervals are taken from the cards supplied by the Department. Distances read on the slope when the vertical angle exceeds 1° 30′ for station courses, and 3° for side shots are reduced to the correct horizontal distance by means of the stadia slide rule.

After the proper corrections and entries have been made in the field books, the traverse is plotted on specially prepared drawing paper. This is a smooth heavy paper, cross sectioned on one side on a scale of ten chains to an inch, and with horizontal parallel lines on the other, spaced one chain apart. The traverse is plotted on a scale of ten chains to the inch and the plotting is done by means of the stadia protractor, which is a semi-circle of celluloid, having bearings marked from 0° to 180°, and in the same direction from 180° to 360°. There is a pin hole in the centre of the circle, and the straight edge of the protractor has a scale of ten chains to the inch reading both ways from the centre to 43 chains.

The allowable closing error in a traverse is 1½% on the surveyor's own work, and 5% when closing on a section or quarter section corner.

The stations are first plotted and the closing error, if not in excess of the above mentioned limit, is then distributed among the courses of the traverses.

In plotting the side shots the protractor is pinned by a fine needle to the corrected position of the station, the north and south points are marked and the various recorded bearings are turned off, and at the same time the corresponding corrected distances are scaled off on the straight edge of the protractor. The outline of the lake in this way can be rapidly and accurately plotted.

It is necessary that the traverse should be plotted before leaving the locality in which it was made so that any mistakes or errors found may be corrected.

A full description is given in the field book, at each instrumental station of the lake, the lake shore, and the surrounding country, and at the end of the traverse notes a complete general description is given of the character and topography of the lake.

These descriptive notes form a basis for the classification of the lake into one of five general classes. These are:—

1st—Lakes that have entirely dried up.

2nd—Shallow lakes likely to dry up.

3rd—Lakes which do not dry up, but which have shore lines subject to large variation—say 10 to 20 chains.

4th—Lakes which do not dry up, but which have shore lines subject to moderate variations—say 5 to 15 chains.

5th—Lakes whose shore lines do not change. This class includes deep permanent lakes with well defined shores.

These different classes are treated in different ways in compiling the township plans. No deduction of area is allowed for class 1 and 2 lakes. Class 3 and 4 are dealt with by selecting the aliquot parts of legal subdivisions which more nearly include the land more or less permanently covered by water. In class 5 lakes the areas are taken to the bank of the lake.

The accuracy of these stadia surveys is highly satisfactory, and is more than sufficient for the purpose in view, namely—the determination of the water areas. Errors of 1% in closing a traverse even under unfavourable conditions, are rare. An extreme degree of accuracy that requires a slower rate of work is not desired in this class of survey. However, if conditions are favourable, the closing error in a long traverse is generally less than 1 in 1,000. The error in closing on section corners is seldom over 2%, and is generally under 1%. High closing errors are generally due to mistakes in the original survey. In townships recently subdivided, or in which resurveys have been made, the closing errors are usually small.

Under favourable conditions, a distance of half a mile can be read accurately to a fraction of ten links. Long courses give the best results, and short courses should be avoided as much as possible. Within the half mile limit, the allowable distance for accurate reading depends on the conditions under which the reading is made. Forty chains may be read more accurately at some times than fifteen chains at others.

On bright days the rod cannot be read accurately against the sun for any distance. This distance is, of course, much shorter when looking across water than in looking across land. This should be carefully kept in mind in directing the course of the traverse. If possible a lake should be approached from the southeast in the morning, and from the southwest in the afternoon. The side shots may then be read with the sun shining on the surface of the rod.

The main hindrance to accurate reading is "boiling," or heat waves in the atmosphere. When this is extreme, the rod, even at as short a distance as ten chains, has the appearance of an attenuated barber's pole, and it is impossible to get an accurate reading on either foresight or backsight.

Another common difficulty is "floating" or "dancing." Here the image of the rod, although clearly defined, floats in the object glass so that the stadia hairs cannot be fixed long enough to get an accurate reading. This is most common when looking across water. High winds spoil the accuracy of the readings, and wind storms on the open prairie are sometimes so violent that it is impossible to read the rod at all. Long readings taken with the sky as a background, or with a very dark back-ground, such as a sheltered bushy bay are inaccurate. The greatest natural difficulties are high reeds on a soft mud bottom, and dense overhanging bush, and when these are found combined on the same lake, the mileage made that day will be small. The transit should be set up as far out from the shore as possible and the rodman,. if unable to hold the rod steady in the air should support it on stakes. They should also wear a hat or shirt of some non-neutral colour, as otherwise considerable time is often lost in locating the rod.

The number of miles that can be traversed in a fair day's work by a stadia survey, depends on too many factors to be estimated very closely. From three to eight miles depending on the amount of bush are average limits. In the dry townships to the south, more of the surveyor's time is spent in investigation and making resurveys than in traversing. The average cost per mile in the season of 1913, was $17.75. The average cost per mile of the four parties in a position to make the most mileage was $12.24 a mile. This includes in both cases, cost of equipment and of all extra time spent on this work, besides traversing. The daily expenses of a stadia party in the field are about $24.00.

The work can be done as cheaply in the fall and early winter, as in the summer, the shortness of the days being compensated for by the ease with which traversing can be done from the ice, and with which courses can be run through the bush when the leaves are off the trees.

The returns for the season of 1914 have not yet been compiled, but there is no doubt that although the season was short, the results will be still better than in 1913, In consideration then of the mileage of traversing done, and the amount of information gathered, it can be said that the object of these surveys has been attained.

In conclusion, I wish to say that the attainment of the object of the stadia surveys was secured by the thoroughness of the preparation made for them by the Surveyor-General and his staff. The instructions issued for these surveys by the Surveyor-General, in the spring of 1913, although stated to be subject to such modification as experience might show to be necessary, suited the work so well that only a few minor changes were made in them the following year. The choice of the best instruments, field books, drawing and transport materials, was attended to with the same thoroughness and experienced foresight.

Mr. Brownlee: This is a good paper and we in British Columbia are deeply interested in Stadia surveys. We would like to have it rearranged so that we could see through the bush. The trouble with us in British Columbia is that we do not use stadia very much on account of the heavy timber. I am very pleased with the remarks about correcting surveys with stadia. In some cases they are more accurate than the surveys.

Mr. Neelands: When there is a large difference between the two it is usually the fault of the original survey.

Mr. Brownlee: This is a very valuable paper. We appreciate this accurate work and I am delighted to come to this meeting, the first in thirty-five years, I am delighted to hear the young men making such advances in accurate work.

Mr. Shanks: I have enjoyed the paper very much. I think we can appreciate these papers very much more when we read them and have time to digest them more thoroughly. I know that Mr. Nash of our office has made somewhat of a specialty of stadia work, and any suggestions from him would be appreciated. I wish to second the vote of thanks.

Mr. Nash: I have been connected with the inauguration of this work. It was started last year. We put a number of surveyors in the field with tentative instructions, but as Mr. Neelands remarks, those instructions were found to be fairly comprehensive although they were not good in some respects. We investigated the work during the winter comparing the results, and during the process of the preparation of township plans we envolved together more complete instruction for this years work and I think we have the thing now on a good working basis. We had no difficulty in handling the returns this year. Everything has gone very smoothly and I think the amount of work done for the length of time the surveyors were in the field compares very favourably with the results of the year before.

Motion agreed to.

The Meeting adjourned.

Evening Session.

"STEREOPHOTOGRAMMETRY AS APPLIED FO SURVEYING."

By W. C. Murdie.

Stereophotogrammetry.

Stereophotogrammetry is the most up-to-date method of making measurements from photographs. This art is of very great service in surveying, and especially in the mapping of rugged country.

Phototopogrammetrical Surveys.

Phototopographical surveys have been made in Europe, Asia and America. In America this method of surveying has not been adopted outside of government engineering circles. Several extensive photo-topographical surveys have been carried out in Canada since 1888. The topographic reconnaissance work in South Eastern Alaska gave Canadian surveyors, under Dr. W. F. King's guidance, a splendid opportunity to show the superiority of this over all other surveying methods, for delineating the topography of a country peculiarly rich in climatic and topographic difficulties. Such men as J. J. MacArthur, in Canada, and J. A. Flemer, from the United States, have been very influential in forwarding the cause of this branch of engineering.

Photogrammetry.

Photogrammetry is the art of reconstructing geometrical horizontal projections from photographs. The latter may be considered as being true perspectives. In order to do this work well, descriptive geometry must be thoroughly understood by those in charge of the work. In 1861, Laussedat became famous by making the first topographic survey, and from it produces a map of the Village of Buc and vicinity near Versailles in France.

Principles of Photogrammetry.

The essential point of locating an object by means of photography, requires that the object in question must be shewn on at least two photographs taken from different stations. Let us refer to fig. 1 for an explanation of the theory. In this illustration let PP and $P' P'$ represent vertical photographic plates, on which S_1 and S_2 correspond to the nodal points of the objective lens of the camera, while a' and a'' are the projections of a certain station A in the landscape shown on both views. The elements of a picture are the principal point, and the distance line. The former is the

FIELD OPERATIONS.

point of intersection of a perpendicular to the plate which passes through the nodal point. The length of this perpendicular, from the nodal point to the plate is the distance line.

Let fig. 2 represent a plate in a vertical position, with S_1 as the nodal point or focus of the objective lens. A is a point in space and is shewn by its vertical projection a. A horizontal plane through S_1 cuts the plane P in hh′ and gives the horizon. A vertical plane V containing the principal point and the point S_1 intersects the horizon line in E. The distance SE is the focal length of the camera used. In actual work the position of E is found by photographing a pair of fixed cross-hairs or their equivalent each time a picture is taken.

Fig. 3 explains a method of finding the proper position of the plate to enable points to be plotted from station S_1, if f, the focal length and the base S_1 S_2 are known. Lay off S_1, S_2 to any convenient scale. Plot f full size. s is the projection of the station S. shown on the plate. The distance S_2 E is scaled from the photograph. From the geometrical construction of the figure, RT, the perpendicular to the base line is equal to S_2 E.

MAKING ENLARGEMENTS.

Before commencing the work of plotting, an enlargement to exactly four times the actual size of the negative is made. and from it are scaled the x and y co-ordinates of several prominent points common to both views.

EXPRESSIONS FOR THE CO-ORDINATES OF A POINT.

By referring again to fig. 2 and applying trigonometry we find, AA′. the elevation of the point in question, above the horizontal plane containing the optical axis, is equal to the product of the actual distance from S_1 to A, and the y co-ordinate of A scaled from the picture, divided by the length S_1A'. S_1A' is found by employing the method of intersections. Therefore knowing the height of instrument, the quantity AA′ and the horizontal length S_1A' the correct position of the nearest contour we wish to plot may be shewn.

ADVANTAGES AND DISADVANTAGES OF PHOTOGRAMMETRIC MEASUREMENTS.

The time required to carry out the field-work is comparatively short, but the office-work is slow and tedious. Corresponding points must be identified and their elevations calculated.

Where a base is short the pictures are very similar and a very acute angle comes in on applying the principle of intersections. When a long base has been employed, the same features have been photographed from two distant and different view points, thus making the recognition of objects difficult. It is a good plan to arrange camera stations so that the angle of intersection will not be less than 30°.

On some occasions it is almost impossible to obtain a degree of accuracy which will be up to the standard required. At such times the plane-table and stadia or transit and stadia may possibly fill the opening. The cause of this great draw-back may be laid upon the nature of the country and the particular use of the map after it is completed.

The main advantage of photo-surveying, over other topographical methods, is the speed with which the field-work can be accomplished. This is advantageous in high latitudes and such places where climate and weather are very uncertain.

Some regions do not permit a party to travel heavily and completely equipped. A small field party with a photo-surveying outfit is quite capable of accomplishing what a large party would do with ordinary instruments, such as plane-tables and transits.

In very many cases tracts of country are laid open for investigation in which a large percentage of the area is impassible, here only the camera can give the required information. Thus we see that photogrammetric methods are most suited to rugged, irregular country, such that the various features may be easily recognized in the photographs.

COMPARISON OF PHOTOGRAMMETRIC WITH STEREO PHOTOGRAMMETRIC METHODS.

The field instruments for photogrammetry consist of a camera and transit while the up-to-date photo-theodelite does the work of these two. A photogrammetric survey is executed in conjunction with a triangulation scheme, from which the camera stations have to be located. On the other hand, with stereophotogrammetric surveying the triangulation need not be so extensive.

The camera and its equipment, used by the Department of the Interior on the Alaska boundary survey, weighed 19 lbs. While the transit, tripod and case complete, came to 14 lbs. On the other hand the weights of the various parts which make up a complete stereophotogrammetric field outfit are as follows:—

Photo-theodelite in its case together with a sighting vane, two plumb-bobs, a Thornton Pickard shutter, and a small tape	41.5 lbs.
Padded travelling chest	37.5 "
2 tripods (solid) with attached visier, each	17.0 "
1 tripod suited to accommodate a shifting head	14.0 "
2 heavy leather caps to protect heads of tripods, each	3.0 "
6 plate holders, box of 12 plates and a leather carrying case	4.5 "
Micrometer bar and case with straps	5.5 "
Attachments for micrometer bar, together with 2 large sighting vanes, in a leather case with straps	3.0 "
Metal tripod, visier, plumb-bob, a sighting vane, all in a case provided with straps	11.0 "
Total weight	157.0 "

This represents the weight of the necessary instruments regardless of plates that will be required on a survey. The travelling chest and tripod caps may be left at headquarters during operations, thus making the weight of the instruments that must be taken into the field for work at each camera station, to amount to approximately one hundred and fifteen pounds. This can be fairly evenly distributed over a party of four men.

STEREOPHOTOGRAMMETRY.

Stereophotogrammetry is a method by which the necessary measurements are made from stereoscopic pictures. Many of the troubles which crop up in photogrammetry are eliminated by the adoption of this scheme. This comparatively new art may be considered as a modified form of the principles made use of in making measurements with a Zeiss telemeter.

USES AND ADVANTAGES OF STEREOPHOTOGRAMMETRY.

Actual applications prove the accuracy of stereophoto surveying to be quite up to the standard of good work executed by stadia methods. *Experience shows that, measurements taken from pictures, made by photo theodelite, (having a focal length of 241.5 mm and a base line of 150 m. being used); for a distance of 1000 m the probable error amounted to less than 0.8m. In railway location work with average distances of 200 to 400m. and base lines ranging from 25 to 50 m., the probable error of the results, in horizontal distance kept within 0.2 or 0.3 m., and within 0.07 and 0.12 m. for vertical heights.

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*Eng. News, Mar. 27, 13.

Photogrammetry requires a good class of photography while this up-to-date method can produce fair results from photographs, not specially noted for their sharpness and quantity of fine detail. Photos may be taken in poor light and yet give fairly good results when examined with the comparator.

Negatives are examined in the comparator, while photogrammetry deals entirely with positives. It is practically impossible to obtain positives without slight inaccuracies which do not occur in the negative.

The pointers in the eye-pieces of the stereocomparator act as a most efficient rodman by travelling over rough and inaccessible ground in infinitely short intervals of time and by never getting lost.

In stadia work considerable time is spent in the field. During cold unpleasant weather it is hard to take the pains that one might exercise when in a warm office examining a minature true landscape.

The ease and rapidity with which measurements are taken and plotted, makes the time required to complete a map comparatively small, when compared with the work necessary to obtain a map of the same area by means of other phototopographical methods.

The exact positions of manoeuvering fleets or armies at a given time may be mapped out with a small amount of work, and in a short interval of time.

Stereo-pictures of the heavens have been viewed and new planets discovered, thus making the phototheodelite and steriocomparator a valuable instrument in an astronomical observatory.

*"The only difficulty that I can foresee is in finding suitable spots for camera stations. Let it be assumed for instance that from one place views have to be taken covering 180° in azimuth, the range of the plate being 60°. It will be necessary to find around the place three bases nearly horizontal, each in a definite azimuth and neither too long nor too short. It may not always be easy to find six spots suitable for camera stations when so many conditions have to be fulfilled; in a rough mountainous country it may be impossible.

Where stereophotogrammetry scores is for coast surveys; with a pair of cameras installed at the two ends of a ship, the survey of the coast is the acme of convenience, rapidity and simplicity. It is the ideal method for surveying uncharted coasts like those of Hudson Bay.

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*Eng. News, May 1, 13, by E. Deville.

Speaking generally, it does not seem open to doubt that provided suitable camera stations can be had, the method will, when other conditions are favourable, prove the cheapest, quickest and often the most accurate of all topographical methods. It will also permit to make easily and conveniently surveys which otherwise are either very difficult or impossible, such as those of inaccessible spots or of objects in motion.

At the time the division of the waters of Niagara Falls was being considered by the International Waterways Commission, I was asked whether an accurate plan of the crest of the falls could be made: stereophotogrammetry alone could do that."

THEORY OF STEREOPHOTOGRAMMETRY.

A few words on the Zeiss telemeter may not be amiss in preparing the way to the discussion regarding the theory of stereophotogrammetry. First let us lay all instruments aside, and look at a collection of objects at different distances from the observer, first, with one eye closed and later with both open. In the former case everything in the field of view seems to be in the same plane. Distance can only be estimated by comparing some known length with other distances in the landscape. When both eyes are open, objects at different distances appear in different planes. Rays reflected from points situated at long distances from the observer enter both eyes parallel. One object will produce its image on a certain place on the retina: another object will give an image in a different place. From the difference of position of the two images we are provided with a means of estimating relative distances.

Let us refer to fig. 4. Parallax is equal to the difference between the two angles L_1 and L_2. Most eyes are capable of distinguishing differences of distance between points so long as B does not become less than 30″. The ability to see these differences depends on two factors: firstly the interocular distances and secondly the perfectness of the eye-sight. Most people are able to command a distinguishing control of possibly 400 or 500 m. with the naked eye. A pair of field-glasses greatly increases this distance; in fact the extent of view may equal the product of the magnification times 400 or 500 m. because the parallactic angle is also magnified. The telemeter is so constructed that by a system of prisms the objectives are placed at a centre to centre distance, which greatly exceeds the distance between the observer's eyes.

For the purpose of explanation refer to fig. 5. In that diagram I and I and II and II are mirrors which reflect the light coming from an observed object so that it enters the eyes E and E. In this way the images formed at M and N are transferred to the eyes, thus as it were increasing the enterocular distance from b to B. The magnitude of the increase of parallactic difference will equal the quotient of the distance M. N. divided by the distance from centre of the eye-pieces. Finally the maximum distance which an observer can control is equal to the product of the magnification times B (the base) divided by b. This factor is called the total plastic and as it increases the converging angle enlarges, and with a value of 80 it is quite possible to see difference of distance where the parallax is equal to three-eighths of a second.

The Zeiss telemeter is merely a relief telescope comprising a double telescope and a telestereoscope. Three models are made the bases of which are 51, 87, and 144 centimeters respectively. Graduated glass plates are so arranged in the eye-pieces that on looking through the instrument a stereoscopic view of a scale is seen extending into space. When a landscape is looked at, this scale seems to fit over the prominent objects. Thus by direct comparison of chief objects in the image with near at hand parts of the scale we can estimate distances very closely. Parallax is not measured but in place of that only a comparison of stereoscopic depth is made with a known scale. This principle is the basis of stereophotogrammetry.

In stereophotogrammetry we have in place of the landscape, photographic plates, (the pictures of the landscape), taken at the ends of a short base line. These views may have been made with the same camera but were restricted to being exactly in the same vertical plane while they were being exposed. Next an instrument corresponding to a telemeter is used to give an exact location of all prominent points. Two pictures of any object made while in the same vertical plane constitute a stereoscopic pair.

STEREO-COMPARATOR.

A stereo-comparator is an instrument by means of which measurements may be made from stereophotographs. It is quite a recent invention gotten out by Dr. C. Pulfrich of the Zeiss works in Jena. The comparator and its co-partner, the photo-theodelite, have a most promising field.

In order to more easily understand how topographic maps may be made from using the apparatus of Dr. Pulfrich it might be just as well to outline the theory of stereographic measurements before going into the detailed description of the instruments employed to obtain all necessary data.

*An examination of figs. 7 and 8 will give us an idea of the principles of obtaining measurements from stereoscopic pictures. Let it be assumed, that there is a definite relation between depth of field and parallax. First consider fig. 7. Let A and B be the points of observation, and let P_1 and P_2 be the images of the distant point P on the picture plane, then x_1 is the ordinate of the left image, and x_2 of the right. The difference between the lengths of AB and P_1 P_2 is the parallax and must equal $x_1 - x_2$ from the geometrical construction of the figure. Let a denote the algebraic difference of the ordinates. When this quantity becomes zero it is evident that P must be at an infinite distance from A or B. On the other hand, as P approaches A or B the parallax increases. In a case where several points lie on a vertical plane parallel to the line AB the magnitude of the parallax for any one of them will be identical with that of any other point in the above mentioned plane.

In taking stereoscopic pictures two rules must be carefully followed, first that the plates must be vertical, and second that they must be in the same plane.—It is not absolutely necessary that the horizontal plane tangent to the top of one plate, touches the upper side of the other plate. In other words the height of instrument at both ends of the base line need not be the same. Only the focal length of the lens and the precise distance between the ends of the base are required. Convention chooses the left station as a point of reference, and the co-ordinates x and y are taken from the left plate. Parallax on the other hand is derived from both pictures.

The following tends to show how the co-ordinates of a point in space may be determined from co-ordinates measured from a stereoscopic pair of plates. Let us refer to fig. 8 where X, Y and Z are the actual co-ordinates of the point P in space with reference to S_1. As yet the values of these are unknown. Let S_1 and S_2 be the ends of the base, f the focal length of the camera, P_1 and P_2 the images of the unknown point P on the two plates with the abscisae x and x′.

From similar triangles the following expressions are obtained:

$$Z = B \frac{f}{x + x_1} = B \frac{f}{a}$$

$$X = Z \frac{x}{f}$$

$$Y = Z \frac{y}{f}$$

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*Applied science, Univ. of Toronto, May, 1912.

The values of a, x and y are read off from the stereographs by means of the stereo-comparator, with a high degree of precision, and are the factors for parallax, horizontal distance and vertical height respectively.

STEREO-COMPARATOR (THEORY).

The instrument used for measuring distances from stereophotographs is called a stereo-comparator. This piece of apparatus is rather complicated, and to prepare one for the intricate theory connected with it, Dr. Pulfrich has equipped an ordinary stereoscope with a stereo-micrometer. An examination of the latter and a certain amount of practice with this instrument will give the principles of stereophotogrammetry.

Let fig. 6 represent a stereoscope, equipped with a stereomicrometer, and bearing a frame R with two rectangular openings, through which stereoscopic photographs may be viewed. Two metal pointers, with their lower ends curved in towards the picture and their up extremities attached to a sliding part of the frame, act as a "wandering mask." On looking through the stereoscope these two appear suspended in space as one.

If a stereoscopic pair of pictures is set in position, the "wandering mark" can be brought into coincidence with any desired point on the picture. Then the co-ordinates x, y and a can be measured. From fig. 6 we see that the pointers M_1 and M_2 can be moved on the sliding scales I_1 and I_2. The micrometer head S is capable of moving the pointer M_2 through short intervals. The scales I_1 and K give the x and y of the point P, while the readings obtained from I_2 of M_2, and the drum s give a function of the angular parallax From this we see that we can make stereophotogrammetrical measurements on any stereoscopic pictures, but the probable error must be large. The purpose of this instrument is to acquaint those interested in this class of work with the general principles governing the use of a stereo-comparator.

The work required to obtain the co-ordinates of any point P is as follows:—Let p_1 and p_2 be the pictures of the point on the left and right plates respectively. First set the pointers M_1 and M_2 on E_1 and E_2 respectively, and take readings on all three scales These values henceforth are the zero readings of their respective scales. It appears that in this position the pointer M is suspended in space at an infinite distance on account of the rays from M_1 through E_1 and from M_2 through E_2 being parallel.

To set the pointer on any desired spot on the picture, close the right eye and by looking through the left eyepiece, place the pointer M_1 precisely over the point P_1. This done, place M_2 in a corresponding position over the point P. Now open both eyes and view the effect produced. M′ and M″ are the images seen (fig. 9). Next turn the micrometer head a small amount backward or forward, on doing this the image of the pointer appears to move to and from the observer and when in a certain position seems to lie exactly on the object in question. When thus placed the readings of the scales can be taken and recorded.

STEREO-COMPARATOR (DESCRIPTION).

A stereo-comparator is an instrument specially designed to obtain the three co-ordinates of any desired points, shown on pairs of stereoscopic pictures taken with its co-partner the photo-theodelite. Figs. 11 and 12 give a front and rear view of the most up-to-date form of stereo-comparator manufactured by Carl Zeiss, Jena. Either photograph shows the two principal castings. The first is the base which rests in a wooden frame and is at least one third the size of the complete apparatus. The second part is rigidly fastened to the first, by bolts, just above the hand-wheel V,

The principal parts may be described in the following manner by referring to the photographs:—

A.—Table carrying the two plates P_1 and P_2. It is nicely fitted to slide horizontally in the direction of the length of the plates and is controlled by the hand-wheel H.

B.—Table of the stereo-comparator, fitted into the top of the second main casting. It moves in a horizontal direction at right angles to the direction of motion of A; carrying the stereo-microscopes. Forward or backward movements are controlled by the hand-wheel V.

C.—Set-screw compensating the differences in height of objects on the two plates arising from the fact that the camera didn't stand at the same elevation at both ends of the base line while taking the stereophotographs.

D_1 & D_2.—Set-screws to adjust the plates P_1 and P_2. Each plate when in position is securely held by a frame, which in turn slides in grooves in the table A. Each frame is capable of being revolved about a pivot placed at one of its ends. D_1 and D_2 govern the opposite ends of these frames and turn the plates any required amount.

M.—A clamp (almost hidden by the support of the lens L) serves to fix the slide carrying the plate P_1. This slide stop is shiftable in the direction of the main table A.

K_1 & K_2.—The objectives of the microscope. Each is fitted with a cylindrical metal band acting as a cover which may be turned to prevent any light coming from the plate beneath it.

Q.—Clamp to secure the plate and prevent movement in a direction perpendicular to length of the table A. A similar clamp situated at the outside end of each plate prohibits motion in a direction parallel to the long side of the plate.

S_1 & S_2—Two illuminating mirrors capable of being revolved about a common axis. Light is reflected by the mirrors and comes up through the negative and enters the microscope.

N.—Clamp, which with the assistance of a small slide stop near it, enables the parallax drum to be set at a desired reading without shifting the right hand plate.

X.—Scale, reading by means of a lens, with an adjustable vernier, for obtaining the abscissae to 0.01 mm.

Y.—Scale, equipped with a reflector and a reading microscope. The vernier is adjustable. Ordinates may be read to 0.01 mm.

Z.—Micrometer screw with an adjustable drum to measure the amount of parallax. All clamps and set-screws work against springs to prevent any unnecessary after motion.

There have been several models of the stereo-comparator, produced by Carl Zeiss, but possibly model D for plates 9 x 13 cm. is the best.

For convenient transport the apparatus can be decomposed into two parts, thus enabling it to be taken to the scene of operations (except in extreme cases) regardless of the means of transport whether by land or water. The stereo-comparator is taken down by disengaging the stereo-microscope from the table B by loosening the set-screw, the top of which is the highest point in fig. 12. Then by merely lifting it off the set-pins, which prevent lateral displacement while the instrument is being used, the upper part is free. Special cases accommodate these two parts.

In model D, O_1 and O_2 are the oculars of the stereomicroscope. The line of sight on looking into the eye pieces is slightly inclined downwards, thus making the process of viewing pictures very comfortable. By the introduction of a system of porro's prisms the images in the microscope are erect and appear as if they were viewed directly from a point overhead. The inter-ocular distance may be readily changed to suit the observer merely by turning the milled head (placed immediately above the eye pieces). Instead of there being pointers as was the case in the stereo-micrometer, there are two balloon-shaped marks with a small cross at the lower end, etched on glass plates placed in the image plane of the microscope. Three scales radiating from the cross-hairs, two in the same straight line which is parallel to a line joining the centres of the oculars, and one at right angles to the direction of the other two. These serve two purposes, the first being a means by which the eye-pieces may be separately focussed to suit each eye. Before commencing work the scales should be clearly in focus. Secondly, a rough estimation of distance may be obtained by a comparison with these graduated lines, to act as a check.

Fig. 10 attempts to illustrate the construction of a stereo-comparator. S, S_2, S, and S_2 are four prisms of the microscope. The lines P, and P_2 may be considered as the plates in position. The system of lenses gives an enlargement amounting to three to six diameters.

The essential difference between the stereoscope equipped with a stereomicrometer and a stereo-comparator is that in the former the pointers move and the pictures or plates remain fixed, while in the latter the pointers are stationary and the plates (negatives) and the eye-piece microscope move. Although this difference exists, still the impression obtained by the observer is the same, as in either instrument the pointers appear to move over a stationary picture.

Use of the Stereo-Comparator.

In making topographical maps by photogrammetry a large amount of tedious work must be done to obtain the required results. It may be partly graphical and partly the application of trigonometric formulae, but never does the necessary amount of work drop very low. To overcome this great drawback, Dr. Pulfrich designed his stereo-comparator and later on a special form of drafting board, upon which the co-ordinates may be plotted with a small amount of trouble and a minimum of calculation. Although these co-ordinates are by no means the actual values of X, Y and Z of any point under consideration, still they are factors of the true distances. Figs. 11 and 12 show plates in position with their film sides downwards. The work of placing the plates is as follows:—The left and right plates are put in their respective frames and rigidly clamped by the clamps Q. Then the illumination is adjusted by revolving the mirrors S_1 and S_2 about their common axis till the negatives are lighted up to the desired degree. This done, a test is made to see whether the principal line of the left picture is exactly parallel to the direction of motion of the stereoscope. This is brought about by closing the right objective and focussing the cross-hairs of the balloon shaped mark on the centre of the small circular hole at the middle of the upper side of the plate. Then the stereoscope is moved by the hand wheel V till the corresponding hole on the lower side of the plate appears. If the cross-hairs and the centre of this hole coincide the plate is in adjustment. If this is not the case, correct one half of the error by means of the set-screw D, and the rest with the hand-wheel H. These operations are repeated till perfect adjustment results. The right plate is adjusted similarly.

On observing a pair of stereoscopic plates taken with a phototheodelite it will be seen, along the right end of each plate somewhere near the centre that there is a pointed projection, the apex of which indicates the position of the horizontal plane which contained the optical axis of the lens of the camera, while the exposure was being made. The difference in elevation between the height of the hub over which the instrument is stationed and the horizon line or horizon plane containing the optical axis of the lens of the camera is called the height of instrument. In practice, it is only in rare cases that the horizon for each picture would be precisely the same distance above sea-level. To overcome this and provide a common horizon line for the two plates, the set-screw C is made use of. It is conventional to consider the left station always, as the reference point, therefore when the left plate is once put in position it is fixed, provided the principal line has been adjusted. After that any adjustment that is to be done must be made on the right hand plate.

The adjustment of the horizon is brought about in the following manner:—Open K and close K_1. Sight any clear and well defined point in the landscape and place the intersection of the cross-hairs exactly over it. Then close the left objective and open the right. The horizontal cross-hair should lie exactly on the same object as was viewed in the left negative. If it doesn't the difference can be illiminated by the set-screw C.

After making all necessary adjustments and having the oculars well focussed, we can proceed to take measurements. First sight through K_1 with K_2 closed, either the upper or lower end of the principal line (the line joining the pin-holes at the top and bottom of a plate). The handwheels H and V enable the cross-hairs to be placed exactly over the above mentioned point. Set the adjustable vernier on the X scale to the nearest whole number and record the reading. Now open K_2 close K_1 and by means of the micrometer screw Z, move the right plate till the point of intersection of the cross-hairs coincides with the centre of the pin-hole of the right plate. Note the reading on the scale at Z. When a certain reading is desired, to be used as the initial reading, the clamp X and a slide-stop are tightened. This enables the zero points on both the horizontal scale at Z and the drum to be set at almost any desired reading without interfering with the position of the right hand plate. Having set the Z vernier, the clamps are released. Next the reading for the horizon is taken from the scale Y, which like the other two has an adjustable vernier.

After the three foregoing readings have been taken, everything is ready to proceed to obtain readings for all points in the picture; K_2 is closed, K_1 opened, and the point of intersection of the cross-hairs brought to bear exactly on a desired point in the left hand picture. Then K_1 is closed, K_2 opened, and the drum Z is revolved till the cross-wires in the right eye-piece lie on the point in question. The scales are read and the results recorded. This method is repeated for each point, the co-ordinates of which are desired. Care must be taken to always turn the parallax drum head against the spring in setting for a point to eliminate any lost motion in the spring.

The relation of the scale readings to the actual values can be shewn in fig. 13, where B is the base line, I and II the left and right stations from which the pictures were taken, and f the focal length of the phototheodelite. It is considered that the left plate is so placed in the stereocomparator that the picture p_1 of the point P lies directly below the centre of the left eye-piece, p_2 is the same point on the right hand plate. The fig. shows the result after the adjustment for any given point (described in a foregoing paragraph) has been made. α is the parallactic angle. A is a function of it, measured by the comparator. If lines be drawn through I and p_1, II and p_2, and produced to intersect, X, the point of intersection is a point in the horizontal plane through I and situated at a distance A from I. X is not necessarily the point p on account of it being in the horizontal plane through I. It is highly improbable that the operator would choose any point for the purposes of investigation that would have the same elevation as the objective of the camera.

From trigonometry we see that the distance of X from, I the left station, is equal to A = B cot.

$\text{Cot } \alpha = f/a$
$\therefore A = B\, f/a.$

Evidently for the same base and focal length where there are several readings of the scale Z. (= a in fig. 13) with a constant value the direct distances from the left station to the different points must be identical. The position of the point N with reference to the principal plane of the photographic plate while being exposed at the left station, is found from the X scale. The elevation or depression of a point is equal to the ordinate y of the left hand plate. Let H equal the difference of elevation above or below the height of instrument. The height of instrument in this case may be considered as the elevation of the horizon mark at the left station above a certain datum. Then by similar triangles.

$$\frac{H}{A} = \frac{y}{f} \quad \therefore \quad H = y \times A/f$$

$$\text{But } A = B\,f/a$$

$$\therefore\ H = y.\ \ B/a.$$

Photo-Theodelite.

The photo-theodelite is the co-partner of the stereo-comparator. This instrument is a combination of a camera and a theodelite. Several models have been made, but that shewn in figs. 14 and 15 can be considered to be quite up-to-date, having all the latest improvements.

Demands Placed upon a Theodelite.

It is only of late that the exact demands which the stereo-photogrammetrical method imposes on a photo-theodelite have been ascertained and dealt with. The earlier forms of this instrument only attained very approximately the chief requisite of the method viz.:—that during the exposure the plates comprising a stereoscopic pair must be in the same vertical plane. This was due to the mechanical construction, but it is well overcome in Model D. In previous forms the principal plane and horizon were obtained from threads placed in the frame of the camera and these were photographed each time a picture was taken. Knife edges were also photographed to give these same results. The results were coarse and somewhat inaccurate. The next point of criticism dealt with the fact that it was impossible after having inserted the dark slide, to make alterations in the adjustment of the camera to the horizontal and to the base line without referring to the cross-hairs inside the camera.

The foregoing defects have been rectified in the following ways. The arrangement of the telescopes, etc., have made it possible to have the plates in the same vertical plane within a limit of less than 10″. Besides this the adjustment can be easily and precisely executed and may be checked and rectified up to the instant of exposure. To eliminate the cross-hairs of old models, a new idea has been introduced. Marks have been placed in the back frame immediately in front of the plate. Since the two pin-holes are in the plane of the optical axis they may be considered as the images of infinitely distant objects. Parallaxis may be measured from these, exactly up to 0.01m.m., if known fixed points in the landscape are to be dispensed with and corrections avoided. The highest admissable angular deviations in the positions of the two plates from being in the same vertical plane is found by dividing 0.01 m.m. by the focal length. The result is the tangent of the admissable angle of deviation.

A moveable horizon mark, which is directly connected with the objective lens of the camera and controlled from the exterior, is shown on each negative. Thus the horizon can be altered after the plate-holder has been placed in position.

Besides there being circular holes to give the principal line, and a horizon marker, to show the horizon, three other necessary markers are to be found in the frame at the back. The first is a permanent number indicating the focal length of the camera. The second and third are changeable numbers which mark on each plate the number of the plate and its series. The series marker is adjustable only from the inside, while the wheel which marks the plate can be controlled from the exterior.

Figs. 14 and 15 show two views of a model D photo-theodelite with a focal length of 129.16 m.m., and capable of taking a picture 9 x 12 cm. The photo-theodelite complete is decomposable in three main parts, viz.:—the head, central metal tripod and a large and very stable wooden tripod. The head comprises three principal parts which exist in fixed adjustable position to one another: the horizontal circle, the camera and the pointing telescope equipped with a vertical circle.

The small metal tripod, the legs of which are clampable levelling screws provided with cap-screws, is capable of being securely fastened to the tripod by a binding screw. The upper side has a cylindrical socket into which the base of the head fits and is clamped in position by the screw-ring R. A small circular level-bubble serves to approximately level the metal tripod before the head is put in position and clamped.

The wooden legged tripods are of a heavy substantial type with a metal head and branching legs to provide extra stability in a high wind. The legs are metal-tipped, and are provided with small projections to enable the instrument man to firmly press them into the ground. One of the three tripods of the set belonging to the University of Toronto has a moveable head, while the other two are stationary.

Now, referring again to figs. 14 and 15, the camera as shown is fastened to a tripod with a shifting head. With the exception of the parts securing the plate-holders in position, and one or two other minor parts, the photo-theodelite is of metal.

A.—Milled focussing wheel for the telescope.

B.—Milled clamp to fix the telescope in any desired position.

C.—Milled slow motion screen to revolve the telescope through small intervals.

N.—Magnetic needle controlled by a small stop shown in fig. 14.

V.—Approximately a 3¾″ vertical circle provided with two verniers A and B, equipped with microscopes. Each vernier gives readings direct to single minutes. Graduations on the circle run from 0° to 360°. A plane passing through the optical axis of the telescope and parallel to either of the mirrors will intersect the circle at 90° and 270° respectively.

T.—Telescope equipped at the outer extremity with an adjustable eye-piece, containing two small concentric circles in its focal plane, which may be clearly focussed to suit the eye of the observer. These circles correspond to the cross-hairs of a transit. A, the other extremity of the telescope; T, and in the vertical axis of rotation there is a prism capable of diverting rays coming from a point in a plane at right angles to the optical axis of the telescope so that they pass along to the eye of the observer. The milled cylindrical projection shewn on fig. 15, immediately below the letter C, provides a good grasping place to enable the operator to turn the telescope about its horizontal axis. The parallel mirrors fastened to each side of the prism serve to reflect the position of the bubble in the level tube just below it.

M.—Micrometer screw with a scale of 1: 20,000 and a pitch of one turn equal to one half millimeter in horizontal distance. The scale readings are made by means of a lens shown in the photograph just above the micrometer drum.

V.—Lever controlling the plate-holder receiver.

H.—An approximately 7½ inch horizontal circle graduated to half degrees, reading from 0° to 360°, and provided with two verniers, I and II, which give readings to single minutes with the option of interpolating to half minutes. A small moveable mirror down near the horizontal circle provides light by which the vernier is illuminated.

I.—Eye-piece of the vernier I.

S.—Small mirror, which when in the proper position reflects a ray of light to hit the small circular hole in the upper side of the frame thus illuminating it.

R. (fig. 15)—Ring screw clamping the head firmly to the metal tripod.

R. (fig. 14).—A milled wheel, controlled by a winged nut, and providing a means of raising or lowering the lens of the camera.

O. (fig. 14).—Shows a red pointer on one side of the objective of the camera. On the opposite side of O, and almost across from the pointer, is a scale giving both positive and negative readings. When the optical axis of the lens produced passes through the centre of the plate in position, the scale reading is zero. Now if we place the arm bearing the mirror so that the reading on the vertical circle attached to it reads zero a ray reflected from the mirror will pass through the lens and the upper circular hole of the frame. In case the scale on the face of the camera gave a negative reading, set the mirror arm so that the circle reading has the same algebraic value as the scale. The purpose of this illuminating process is to light up the plate behind the hole in the upper side as in nearly every case the dark foreground of the picture comes in and thus, that extremity of the principal line might not be so clearly shown.

O.—Objective lens of the camera.

P.—Mirror on either side of the prism.

The objective lens of the photo-theodelite is an anistigmat Ortho Protar, and is very suitable for both photo-grammetrical and stereo-photogrammetrical exposures. Its fine definition from centre to margin of the plate makes it so. The horizontal image angle is about 45°. Thus eight views complete the horizon. The photo-theodelite has a universal focus. A small close fitting cap acts as a protection for the lens against injury while not in use, and may be used as a shutter at the discretion of the operator. An ordinary Thorton-Pickard window blind shutter can be easily fitted to the metal casing surrounding the lens and acts very well as a shutter.

The back frame has been carefully ground and presents a perfectly plain surface. It is so adjusted that it is precisely parallel to the vertical axis of rotation of the instrument. The circular holes have a decided advantage over the knife-edge projections, that were previously used, in that, differences of illumination cannot effect the position of the marks made on the plate.

A frame containing a ground glass screen serves to protect the interior of the camera from dust and other injurious agents more than anything else, while the instrument is not in use. This ground glass frame can be removed at will and replaced by a specially made plate-holder containing the photographic plate.

The operator should be particular regarding the kind of plates used. Plates too thin or those with a very uneven surface should not be accepted. Selected mirror glass plates of about one and a half millimeters in thickness should only be used for receiving the photographic sensitive surface. Chromo Isolar, backed plates to keep down hallation, with a speed of 125-140 H and D give very good results. They may be returned to the office and developed as soon as convenient after they have been exposed. Care must be taken to keep the left and right plate of each stereoscopic pair as near the same density as possible. The manipulation of these plates is similar to that of most dry plates.

The plate-holders for this instrument are of a very good quality, and have been carefully made. Springs keep the plate pressed well in a fixed position. A leather case capable of accommodating six double holders presents an easy means of both transportation and protection against injury. The holders are numbered consecutively from I to VI with Roman numerals, while the whalebone slides bear numbers from 1 up to 12. In this way errors are not so liable to arise, such as exposing one plate twice, etc.

On account of certain requirements in the work, at least two tripods are required to support a photo-theodelite for the purpose of making stereo-photogrammetrical topographical exposures. One must be placed at each end of the base line. For topographic work it is unnecessary to have more than one photo-theodelite, since all objects that are to be taken may be considered as still. Where work is being done on moving objects two identical photo-theodelites are necessary and plates in such cases have to be exposed simultaneously. In our class of work, viz.:—topography, the tripods have been so designed that any one of them will accommodate the camera by allowing it to be quickly inserted and rigidly fastened. Where extreme rigidity is desired, rock sacks may be suspended from legs. These may be filled with heavy material during operations and emptied on leaving the station.

Each tripod is equipped with a red sighting cone and a circular spirit level. In some cases the cone is attached by means of a chain to the tripod, while in others the cone can be taken away from one tripod and placed on another.

The complete field outfit belonging to the University of Toronto is shown in fig 16. The different parts are as follows:—Three tripods, one with a shifting head and a detachable metal tripod, and two tripods of the solid type, a micrometer bar, its case and attachments, the photo-theodelite, its box, and a large padded transportation chest (D). Two tripod caps (one marked E), a small leather holder (c) to accommodate the support (G) of the micrometer bar and its telescope, a box (B) which holds the metal tripod of the main tripod (F), a plumb-bob, a black and white target, such as is seen on the right-hand tripod, and a sighting cone for tripod (F).

So far the theory and instruments of a stereo-photogrammetrical survey have been discussed. Now a brief outline of field instructions will be given.

FIELD-WORK.

The field party for a small district offering comparatively easy access should comprise, a chief, chief assistant to act as a recorder, two or three packers and a cook. If the chief or first assistant are not proficient photographers it might be wise to have a photographer along with the party to develope the plates and make sure the work is satisfactory before leaving a certain area that has been photographed. The instruments required would be those shown in fig. 16—with possibly a fourth tripod. A small portable dark room and a supply of good fresh photographic chemicals and apparatus should be kept on hand to develop some, or possibly all the plates to see how the results are progressing.

A general reconnaissance of the country should be made to ascertain the best points to be used as camera stations. It might be advisable in some cases to make a primary triangulation survey, using a theodelite. This having been done, and signals erected at each station, the camera work could be commenced. In all probability stations suitable for trigonometric surveying would satisfy the required conditions of a stereo-photogrammetric survey.

SIGNALS.

Signals used to mark triangulation stations or camera stations, where wood is scarce, are of various types. One style used in Canada is made of telescoping stove pipes of sheet iron, painted black, in two foot lengths and standing ten or twelve feet high when erected. The lower end of the pipe is five inches in diameter, while the upper is two inches. This standard which supports a white flag about four feet by four feet with a conventionally designed black mark on it, is supported by four guy wires. Whenever possible a cairn three or four feet high is erected around the base to give stability. Fig. 17 shows type of signal used on Bagdad railway survey.

BASE LINE MEASUREMENT.

Suppose the camera stations have been chosen and signals have been erected at one or two of them. A third station is occupied and the photo-surveying instruments are taken to it. A stereo-telemeter is a useful instrument with which to obtain approximate distances to certain conspicuous points. Take the mean of these distances and from that compute a suitable length of base to be used to give good results.

The necessary length of base is found by differentiating the formula:—

$$A = f.\,B/a$$
$$dA = f.\,B/a^2 \text{ x } da$$
$$a = f.\,B/A$$
$$\therefore dA = A^2/Bf \text{ x } da$$

This shows that the error in locating points increases as the square of the distance and decreases with an increase in the product formed by the length of Base and focal length of the camera. Consider that a certain permissable error in horizontal distance is allowable. For example let the permissable maximum value of error be 5 m. in 3000 m.

Let f = 129.16

da = The parallax error = 0.01 m.m.

$$dA = \frac{A^2}{B.\,f.}\,.\,da$$

$$B = \frac{A^2\,d.a.}{dA.\,f} = \frac{3000)^2\,(.01)}{(5)\,(126.19)} = 142.64 \text{ m.}$$

It is advisable to keep the length of the base line within 80% of the theoretical one.

Another method of judging the length of the base required is to make it approximately a certain percentage of the distance to a conspicuous point in the centre of an area under investigation. 10 is a good general value of this percentage.

In case only one set of pictures are desired, the base must be chosen so that it is practically parallel to the face of the landscape to be surveyed. The left station is taken as a reference point. The camera, mounted on the tripod with the shifting head, is set up over the centre of the hub by means of a plumb bob, suspended from the vertical axis of the camera and levelled up. The process of levelling is carried out by means of the level bubble on top of the camera immediately below the mirror of the telescope. The reflected image of the divisions of the level tube is transmitted to the observer's eye by one of the mirrors. Once the photo-theodelite has been levelled up, provided the level bubble is in adjustment, it need not be touched again for that position of the instrument. While the chief is adjusting the camera, the assistant may be setting up and levelling the other tripod by means of the box level. The sighting cone may be placed in position and the screw ring tightened. Then either the micrometer bar with its accompanying telescope, or the sighting target may be placed in position. The sighting target has an acute angled strip of black the centre of which lies in the vertical axis of the visier with a background of white.

The position of the second tripod is somewhere on the circumference of a circle the radius of which is approximately the theoretical value of the required base line. To locate it definitely the instrument man may sight along the telescope and swing it till it points to the centre of landscape. Clamp the camera in this position and place the tripod so that the concentric circles of the telescopes can be made to fit approximately, by rotating it about its horizontal axis, between the sides of the black triangular strip on the sighting vane of the second tripod. Then level the tripod and everything is ready for operations.

The photo-theodelite has no finder of the ordinary type. Instead, it has a special form to enable the operator to estimate the vertical and horizontal field which will be taken in by the picture. Four red coloured and neatly pointed projections are situated on the upper surface of the camera. Two are placed in the vertical plane passing through the optic axis of the telescope, one being along the face of camera and the other just behind the magnetic needle. Two of the four points are situated at equal distances to the left and right of the one on the face of the camera. These provide a means of obtaining the horizontal field. On the left side of the theodelite (when the lens is facing away from the operator) are arranged three other red points also in the form of an angle with the vertex at the objective, so that by sighting along the arms of the angle, the observer may ascertain the vertical field that is taken in. By raising or lowering the adjustable point in front the image of the landscape falling on the plate can be altered to a large extent.

When the base has been suitably chosen and the tripods levelled the focal plain of the camera is placed in a vertical plane, parallel to the base line. The camera is turned to face the landscape, the telescope is revolved till the eye-piece looks towards the second tripod. The instrument is revolved by hand about its vertical axis till the concentric circles of the telescopic eye-piece are close to being in the vertical plane passing through the sighting cone. The axis is now clamped and the micrometer screw provides a slow motion by which the centre of these concentric circles is placed precisely on the vertical axis of the sighting cone. Then the telescope is clamped and sharply focussed and revolved by the slow motion screw till one of the circles in the eye-piece exactly fits the black cone at the other end of the base.

Next the ground glass is removed, the series disc and the plate numberer are made to give their proper readings, and plate holder number I with plate number one facing the lens is shoved into its receptacle. The diaphragm is set, the shutter attached and wound up, and finally the slide for plate number one is pulled out and the frame supporting the holder is put in its proper place and locked by the lever. (Fig. 15). The horizon mark is set to give the desired effect and the reading of its scale noted and laid off on the circle connected with the mirror arm. The last operation before making an exposure is to check the level reading to see that the vertical axis is plumb and to look through the telescope and make sure that the plate is parallel to the base.

After the exposure has been made the horizontal circle readings are noted and recorded, and the base line is measured, but the discussion of this will be given later. Then the camera is moved over to the other tripod and a similar list of operations are carried out there, as were made at the left station.

There are two clamping and slow motion screws, one above and one below the horizontal circle. Suppose the screw-ring has been tightened and both clamps are set, the camera is fixed in position. If the lower clamp is released only the horizontal circle is free to revolve. Suppose the telescope has been sighted on the initial station and all readings are to be taken from vernier I. If the operator so desires, he can have the first horizontal circle reading equal to zero by setting the 0 mark opposite the zero, by setting the 0° mark opposite the zero of $_1$ vernier, roughly by hand

and precisely by means of the slow motion screw. Next the upper clamp is released and station number two is pointed. The concentric circles of the eye-piece are brought approximately onto the proper point by hand and exactly by means of the micrometer screw. The vernier is read. Points three, four, etc., are sighted and their corresponding circle readings taken and recorded in their proper order. By setting the horizontal circle at any desired readings, fixing the lower clamp and by turning the camera always clockwise or contra-clockwise (as the operator chooses) from station one (the left station) around through a complete horizon and pointing all points from one back to one again, the initial and final readings ought to be identical.

Where a primary triangulation system has been made, usually one of these stations serves as a reference point and the angular direction of the base line with reference to a known line (joining the left station to any visible triangulation station) is taken by the photo-theodelite. It is only necessary to know the length of the base line and its bearing. All points in the landscape can be plotted and a contour map prepared of the area taken in by each pair of stereoscopic pictures. Of course angular readings to a few conspicuous objects can be taken as checks, but they are not absolutely necessary.

The base line, which is the horizontal distance between the vertical axis of the camera when on the two tripods, is measured by means of a ·micrometer attachment. The principal of the measurement is similar to other micrometer methods of taking distances, viz.:—that of having a micrometer screw of a certain pitch placed at a known distance from the axis of rotation of the instrument and capable of revolving the head of the theodelite so that the optical axis of the telescope may first lie on the left end, for instance of a known length, and be turned by means of a screw till the rlght end has been reached. The measured length, called a micrometer bar, is one metre long, triangular in shape and made of metal. The centre, marked by a black circle with a fine line indicating its diameter, serves as a zero point. The graduations on one side of the bar differ from those on either of the other two sides. For instance, one set of divisions divides each half of the face longitudinally into ten equal parts, every second being numbered. The numbers start from zero and go to left and right respectively. The size of the figures increase as the distance from the centre line of the bar. Although one half of the length of the bar is only fifty centimeters, the numbering would lead one to think that it were one metre long. The reason for this will be seen later. The above described side of the micrometer bar is used in taking short distances. When a long base is to be measured, the side, with only the zero point and the extremities of the metre marked by thick black lines, may be used. The third side provides a means of obtaining the distance between two ends of a base line, when the intervening distance prevents the numbers on face number one to be clearly seen or even the black lines at the limits of face number two.

A holder, which clamps upon the visier, supports the measuring bar. A small telescope, provided with cross-hairs, and set in the holder so that it may be elevated or depressed about an axis lying below the horizontal axis of the micrometer bar makes it possible to place the micrometer bar at right angles to the base line. Fig. 16 shows the micrometer attachments fastened to the left tripod ready for use.

The upper clamp and slow motion screw of the horizontal circle serves two purposes, viz.:—as a micrometer screw and as an ordinary slow motion apparatus. The screw is provided with a measuring drum divided into one hundred parts, thus giving readings to 0.005 m.m. since the pitch of the screw is; one turn equals 0.5 m.m. From these values the result shown along with fig. 18 can be derived.

It is absolutely unnecessary that the ends of a base line be of the same elevation, as the micrometer measurement only gives the horizontal projection of the base. To increase accuracy, care must be taken to prevent lost motion in the micrometer screw. This may be done by always turning the screw against the spring. In case a reversing action must be made, turn back at least one half a turn past the desired mark and then bring it on by the pressing or positive motion.

To eliminate any possible error, due to the micrometer bar being swung away from being at right angles to the base line, a good method to follow is to sight on a certain division on either end of micrometer measuring apparatus, take and record the drum reading, then swing over to the corresponding mark on the other end of the graduated length and again take the drum reading.

To find the length of the base, proceed in the following manner. Suppose we sight on 0.2 on the left end of the bar and 0.2 on the right end, and have recorded the drum readings for each. The difference between the micrometer readings is found by subtraction. The known length covered in obtaining this difference is equal to the sum of the distances from the centre of the bar, viz.: 0.4. Then multiply 0.4 by 10,000 and divide by the difference between the micrometer readings. The result is in centimeters. For increased accuracy several readings should be taken on various parts of the bar and the base length computed for each set of readings. Then take the mean of the results.

To produce stereo-photogrammetrical exposures, two tripods are absolutely necessary. In many cases it is advantageous to have a third tripod or even a fourth. Fig. 19 shows the proper arrangement and advantages of a three tripod system, while fig. 20 brings out the method of overcoming the fact that three tripods will not give a complete horizon.

In using three tripods it is advisable to set them up in the form of a right-angled iscosceles triangle. Thus we obtain three base lines. When four tripods are used they should be suitably set at the four corners of a square. Here we have six base lines, but cover 360° since there are eight pointings each of which takes in 45°. Comparing the 360° with the 135° as obtained from three tripods the advantages can be readily seen, why four should be adopted instead of three for a station commanding a view of a complete horizon.

PLOTTING.

After the field-work has been completed and the stereoplates developed, the mapping must be done. Triangulation and camera stations are plotted by one of the best methods of projection and the topography is worked in from these points. In all probability nothing is done towards delineating the country under examination till the office is reached. There, in most pleasant surroundings and under practically no aggravating circumstances, the miniature landscapes of stereoscopic pairs of photographs are viewed on the stereo-comparator and the x, y, and a co-ordinates of each desired point read and recorded. Later these points are plotted either on a specially adapted drawing board or by means of a stereo-autograph.

The following attempts to describe the method of using the drawing board together with the graphical construction necessary to obtain the horizontal projection and the elevation of the point P from the measured values x_1, y_1, and $a = x_1 - x_2$.

Plate XVI gives a diagrammatic explanation of the process. In order to maintain the same precision in the map as that of the stereo-comparator ($a = 0.01$ m.m.), we write the known formulae for A, X, and Y as follows:—

$$A = B . f/a$$
$$X = A . x_1/f$$
$$Y = A . y_1/f$$

Then the following is also true:—

$$A = kB . nf/kna$$
$$X = A . nx/nf.$$
$$Y = A . ny/nf$$

Plate XVI is a photograph taken of the small drawing board on which a special form of tracing paper has been mounted. A detachable metal straight-edge is shewn clamped in position at the lower side of the board. This serves as a T-square. Angling across the board and fastened to the left extremity of the line M_1O by means of a pin, is another straight edge which can be used as a scale. The bevelled edge of the scale produced passes through the centre of the metal plug about which the straight-edge is revolved.

A slab of plate glass, covered on both sides with an opaque white paper makes a smooth and uniform draughting board. This is securely fastened to two wooden supports.

Before commencing work various lines M_1O, T_1 and T_1, S_1, S_2, S_3, etc., are carefully laid off and inked in on the upper surface of the paper covered drawing board. M_1O bisects the draughting surface longitudinally. T_1 and T_1, S_1, S_2, S_3, etc., S_n are perpendiculars to M_1O. T_1 and T_1 are divided into mm. and act as measuring lines. The points of intersection of these two lines with M_1O are origins for certain measurements at right angles to M_1O. The positions of the lines S_1, S_2, S_3, etc., are found by starting at M_1 and by laying off the focal length of the camera in mm. as often as the length of the line M_1O will permit. The limits of these lengths are marked by the expressions f, 2f, 3f, etc. Through these points perpendiculars are drawn upwards from the line M_1O, giving S_1, S_2, S_3, etc. S_n (In plate XVI S_n is S_5). Each is provided with divisions, the interval between which is 1, 2, 3, 4, – n. mm. The last perpendicular is divided throughout its whole length, while only the upper ends of the others are divided. The divisions are left unfigured.

A special form of tracing paper is fastened to the drawing board by pasting it to the edges of the board. Then all the above mentioned lines show through clearly. Then they should be numbered and lettered similarly to plate XVI with a soft lead-pencil.

The boxing into which fits the conical plug for the drawing scale, is covered by tracing paper. A hole is cut in the paper to provide free access to the seat of the conical plug. As soon as the plan has been finished this hole can be filled by pasting over it another piece of tracing paper. The exact position of M_1 (the centre of the plug) can be at any time reconstructed from two intersecting straight lines made with the straight edge. L_1.

The line S_n is furnished with two scales by the observer (one for X and one for Y.) These divisions begin at M_1O. The readings for the X and Y scales at the intersection of M_1O with S_n are those readings to which their respective verniers were adjusted.

Next the observer must decide on the horizontal scale of his map. He chooses a point in the landscape at the greatest distance which will be in the included area, and takes the x, y and a reading for it from the comparator. Then by a process of trial and error a scale is chosen where 1 m.m. of the drawing is equal to e m. in nature, which when applied to the point in question will bring it just inside the edge of the sheet. It is not absolutely necessary to draw the plan in any particular scale, as reduction may be made by means of a pantograph or by photography.

Now the auxiliary line N N must be drawn. The distance of it from M_1O depends directly, as the length of the base B and inversely as the scale e, in which the map is to be made and is equal to $\frac{B.K.}{e}$ mm. where R is one of the following quantities.:—

$$5, \quad 10, \quad \frac{25}{2}, \quad \frac{50}{3}, \quad 20, \quad 25, \quad \frac{100}{3}, \quad 50.$$

It is good practice to have N K up pretty well towards the upper edge of the drawing board to give a good intersection at the point S. Choose a value of K which will place N N in such a suitable position. Lay off on T_1 the value of $\frac{B.K.}{e}$ in m.m. at each end of the board and join the points.

By the use of this given value for K each interval of the divided lines S_1, S_2, S_3, etc. S_n is equivalent to a change in the parallax "a" of 20, 10, 8, 6, 5, 4, 3, 2, hundredths of a m.m.

Then letter the single scales correspondingly with their zero point at M_1O. For example where B = 4.671 m. e = .500 and $K = \frac{50}{3}$ the value of the expression $\frac{B.K.}{e} = 155.7$ m.m.

After the preliminary constructive work has been executed the graphical solution of the horizontal position and the elevation of the point P can be encountered. Place the straight-edge L on the value of a for point P, mark the point S and drop a perpendicular GG. Next set L on the proper X—scale reading for the point P. The intersection of the line GG with the revolving scale gives the exact horizontal projection of P. Then to obtain its elevation above a certain datum place L, on the Y value of the scale, reading for P and obtain R. M_1O is on the horizon of the left plate. Next plot the datum line. The distance of the datum below the horizon is equal to the height of instrument less the elevation of the datum divided by the horizontal scale e of the drawing. Scale off the length from the point R down to the datum along the line GG and multiply by the scale. The result will be the elevation of P above datum. If a metric scale is used to measure the length of GR the elevation will be in meters, but where GR is measured in inches the result will be in feet and tenths of feet. A horizontal scale of 500:1 may mean that 500 m.m. in nature is represented on the map by 1 m.m., or it may mean that 500 feet in nature is represented by 1 foot on the plan.

All controlling points in a stereoscopic view are plotted in the foregoing manner. The elevation of each should be marked in pencil as shewn in plate XVI. Then make a tracing of the points and their elevations together, with the line M O, and transfer them to the sheet upon which the camera stations were projected.

The azimuth of a certain course in the primary triangulation is obtained by an observation either on the sun or on polaris. The different angles of the triangulation system are measured with either a theodelite or an ordinary surveying transit according to the desired accuracy of the results. From these values the azimuth of a line joining any two triangulation stations can be computed. During the operation of taking stereoscopic plates the inclination of the base line for each pair of pictures from a line of known azimuth is read off from the horizontal circle of the photo-theodelite. After the results of each pair of plates have been properly transferred to the compiling sheet, the contours can be easily sketched in.

Specifications governing the lettering of other topographic maps apply equally well to maps made by stereophotogrammetrical methods. It is a well known fact that the beauty of a topographical map rests largely on the quality of lettering placed on the sheet. For instance, a considerable time may be used up in accurately locating the artificial and natural features and artistically placing them on paper, but the good appearance soon deteriorates if a rough and inappropriate style of lettering is employed.

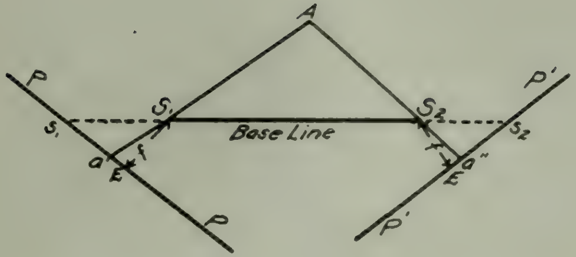


FIG. 1.

Fundamental Principle of Locating a Point in Space by Means of Photographs.

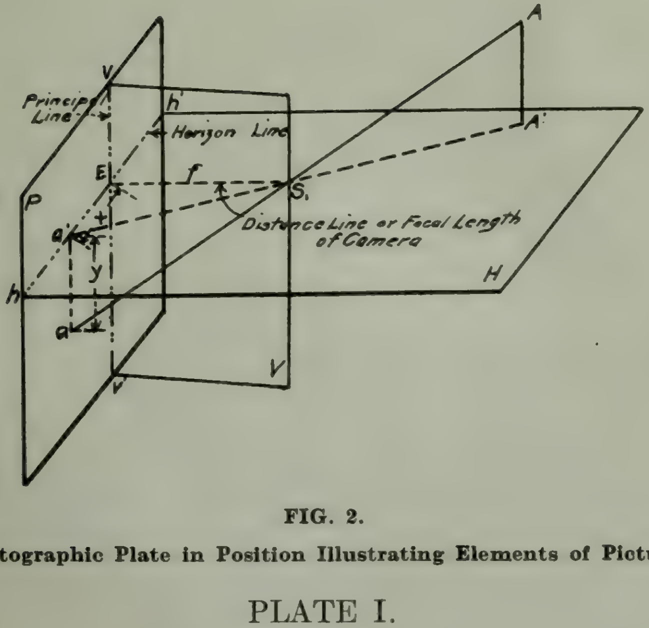


FIG. 2.

Photographic Plate in Position Illustrating Elements of Picture.

PLATE I.

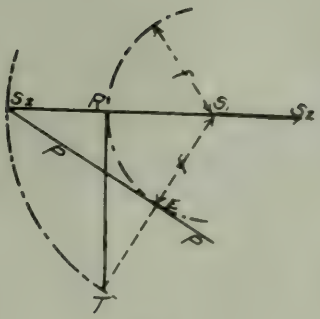


FIG. 3.

Placing Plate in Position for Plotting.

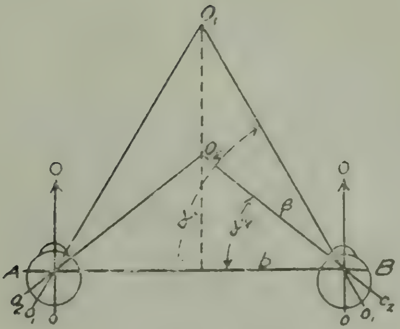


FIG. 4.

Stereoscopic Effect of Distant Objects on the Retinas of the Eye.

PLATE II.

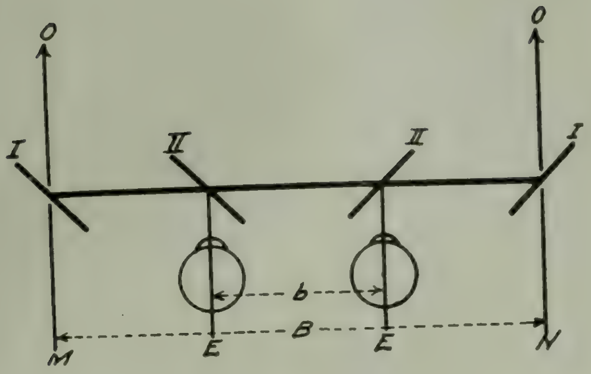


FIG. 5.

Principle of the Telestereoscope of Helmholz.

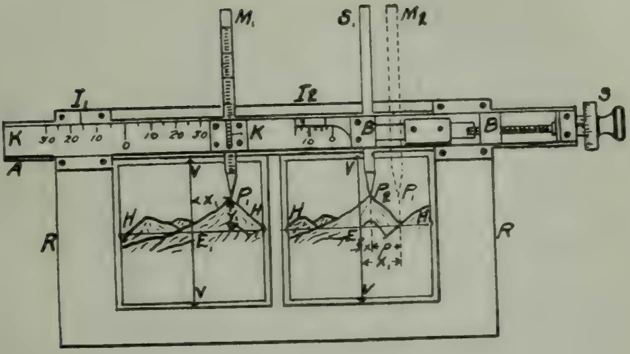


FIG. 6.

Stereomicrometer Attachment for an Ordinary Stereoscope.

PLATE III.

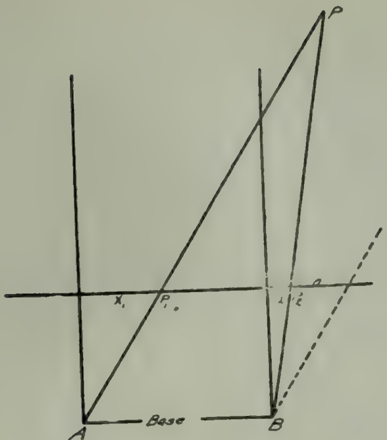


FIG. 7.

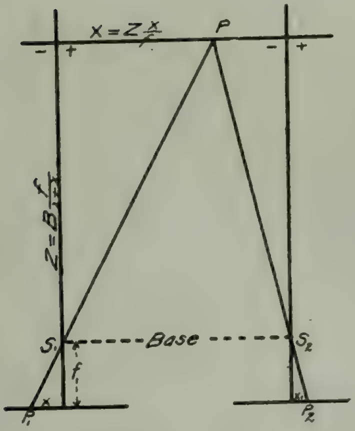


FIG. 8.

PLATE IV.

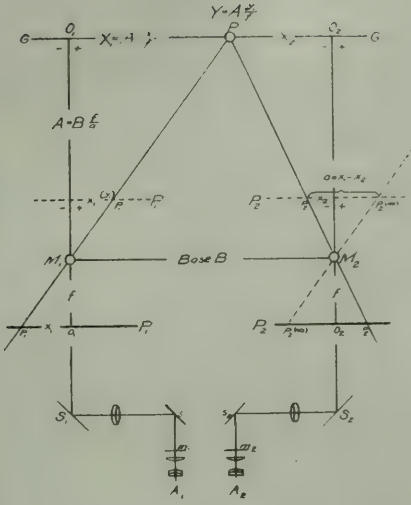


FIG. 10.

Diagram Illustrating the Construction of a Stereocomparator.

PLATE V.

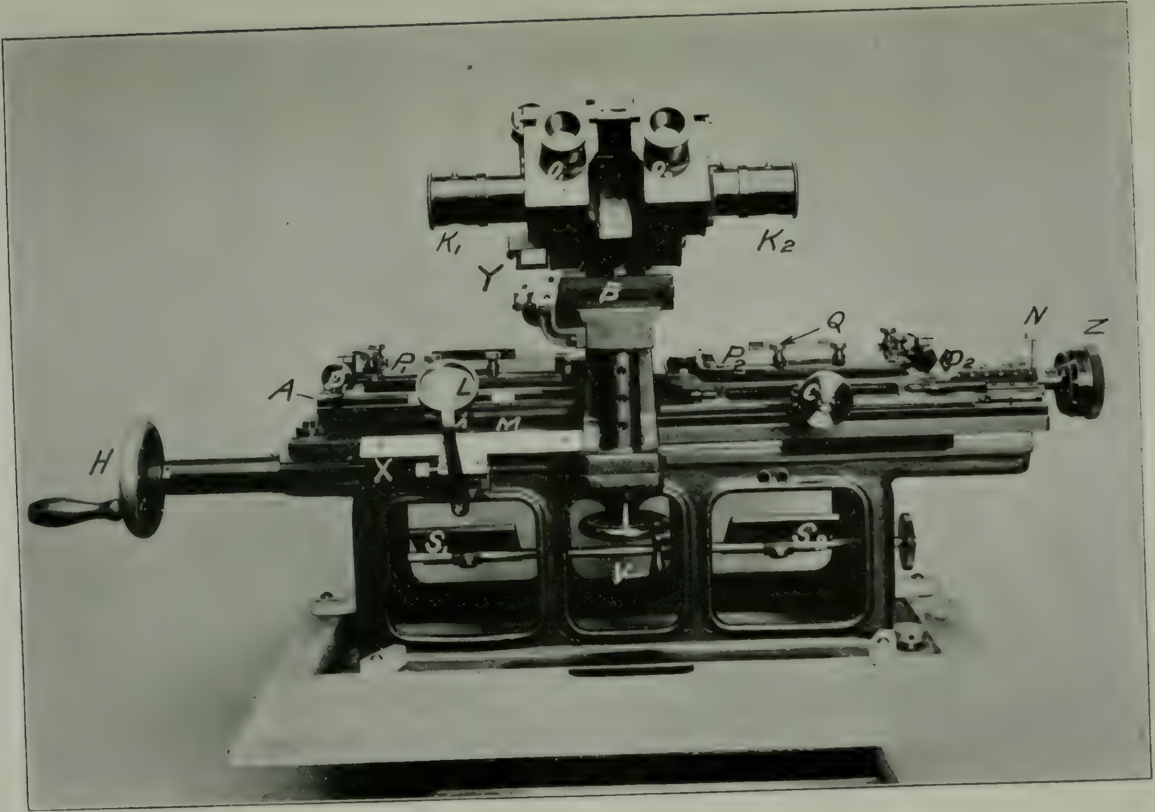


FIG. 11.

PLATE VI.

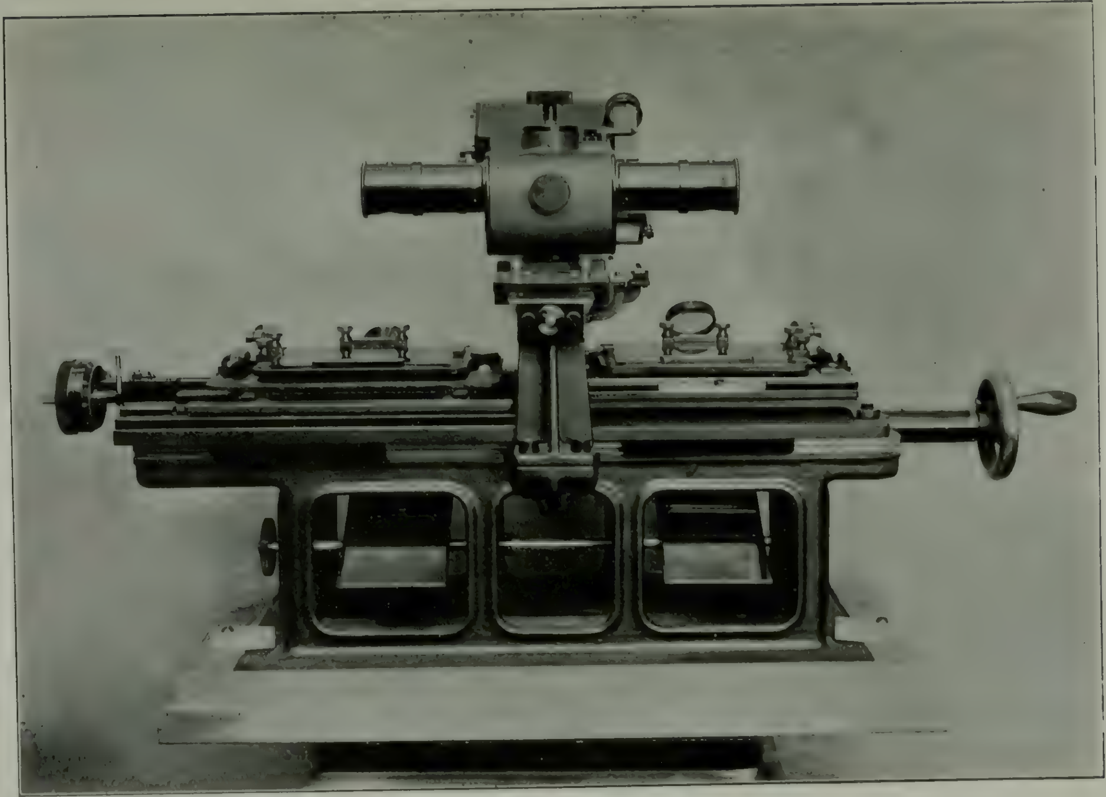


FIG. 12.

PLATE VII.

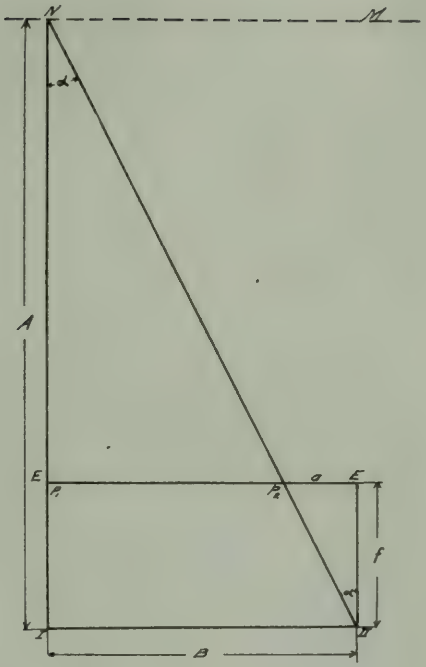


FIG. 13.

Showing relation between scale reading and the actual distance.

PLATE VIII.

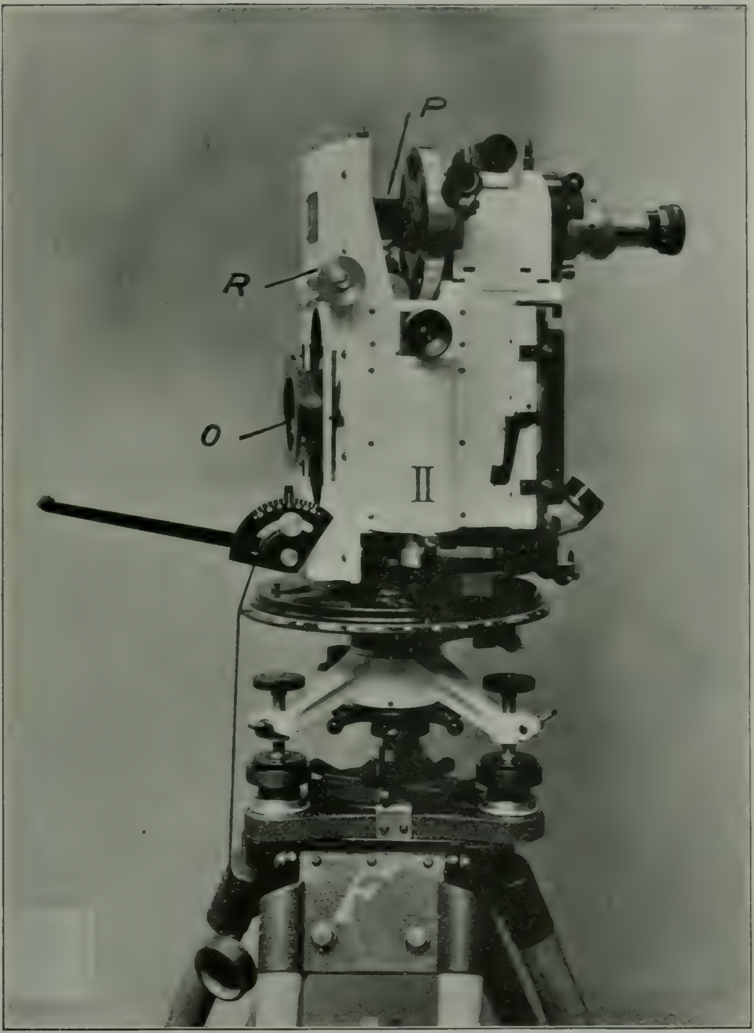


FIG. 14.

PLATE IX.

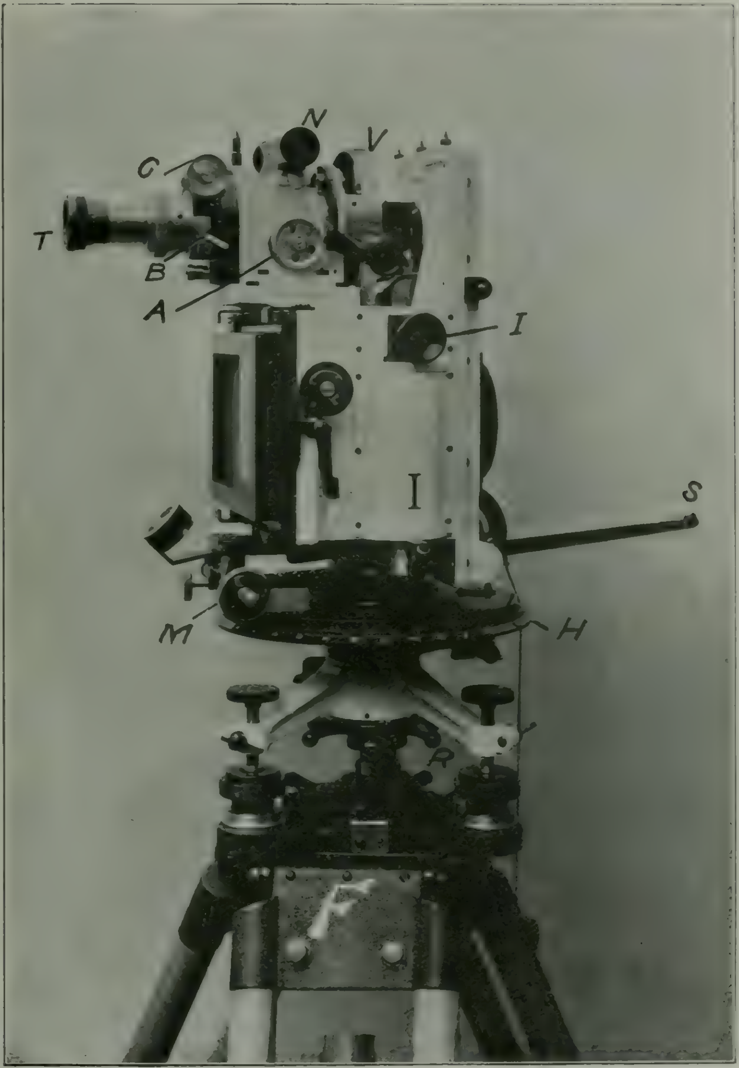


FIG. 15.

PLATE X.

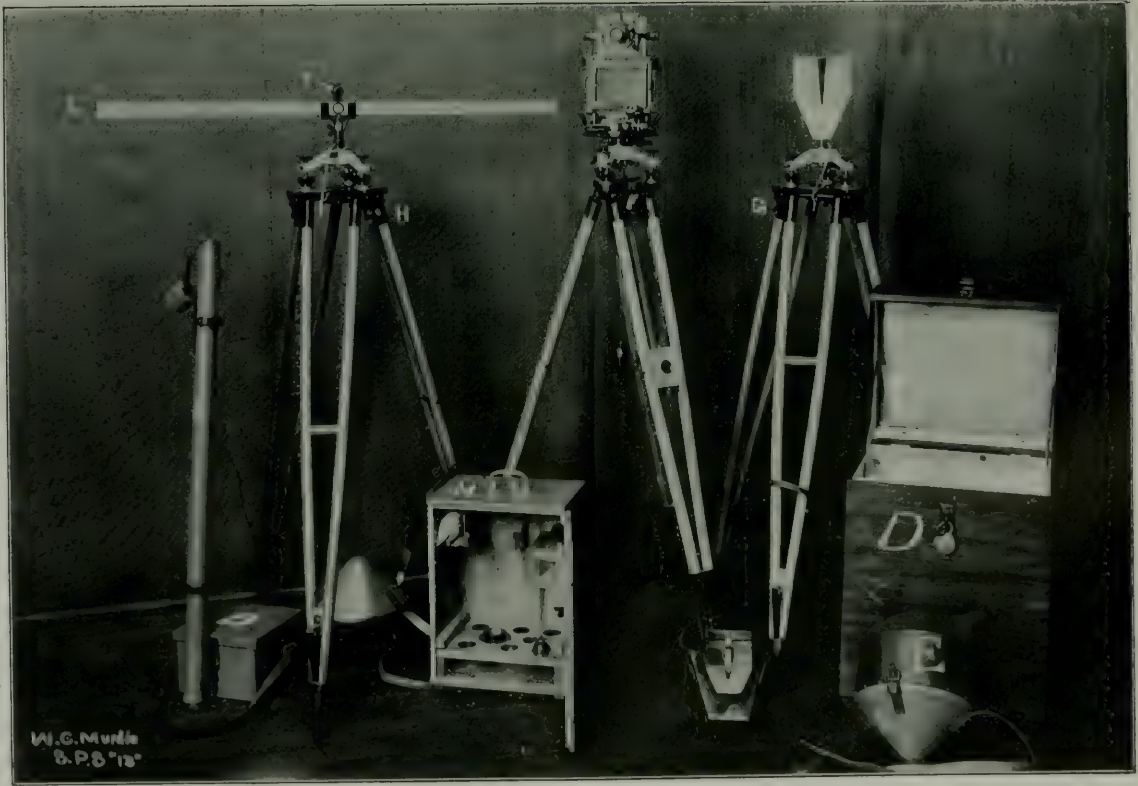


FIG. 16.

PLATE XI.

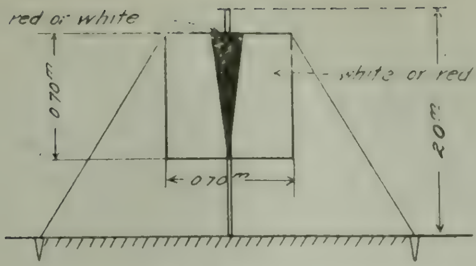


FIG. 17.

Type of Signals for Stereophotographic Survey for Bagdad Railway.

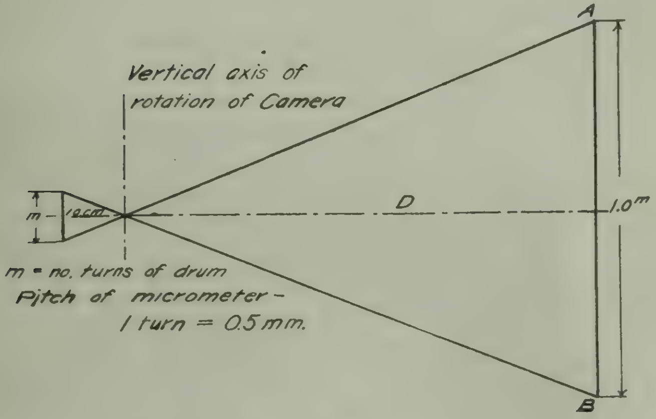

A
Vertical axis of rotation of Camera
m
10cm
D
1.0m
m = no. turns of drum
Pitch of micrometer - 1 turn = 0.5 mm.
B

FIG. 18.

$$\frac{m}{2} : 10 = 50 : D$$

$$\therefore D = 1000 \div m$$

$$= 1000 \times 2 \div m = 20{,}000 \div m \text{ millimeters.}$$

To save trouble of dividing mic. reading by 2 to obtain proper value of m, the micrometer bar is graduated as though it were 2.0 m. in length, and D is equal to 10,000 ÷ m (the number of turns of drum) multiplied by the length intercepted on the bar AB.

PLATE XII.

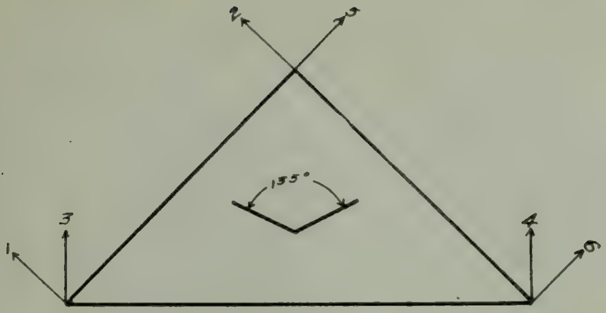


FIG. 19.

Showing 3 tripod arrangement.

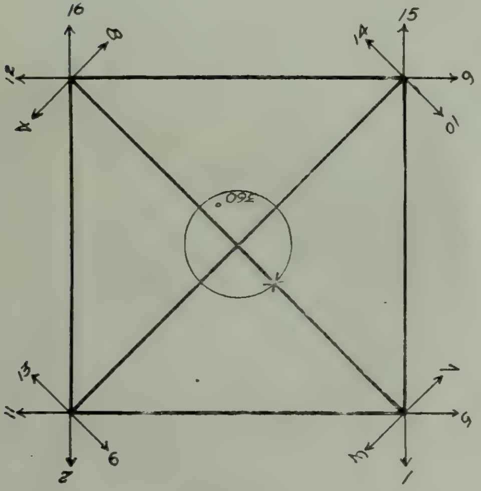
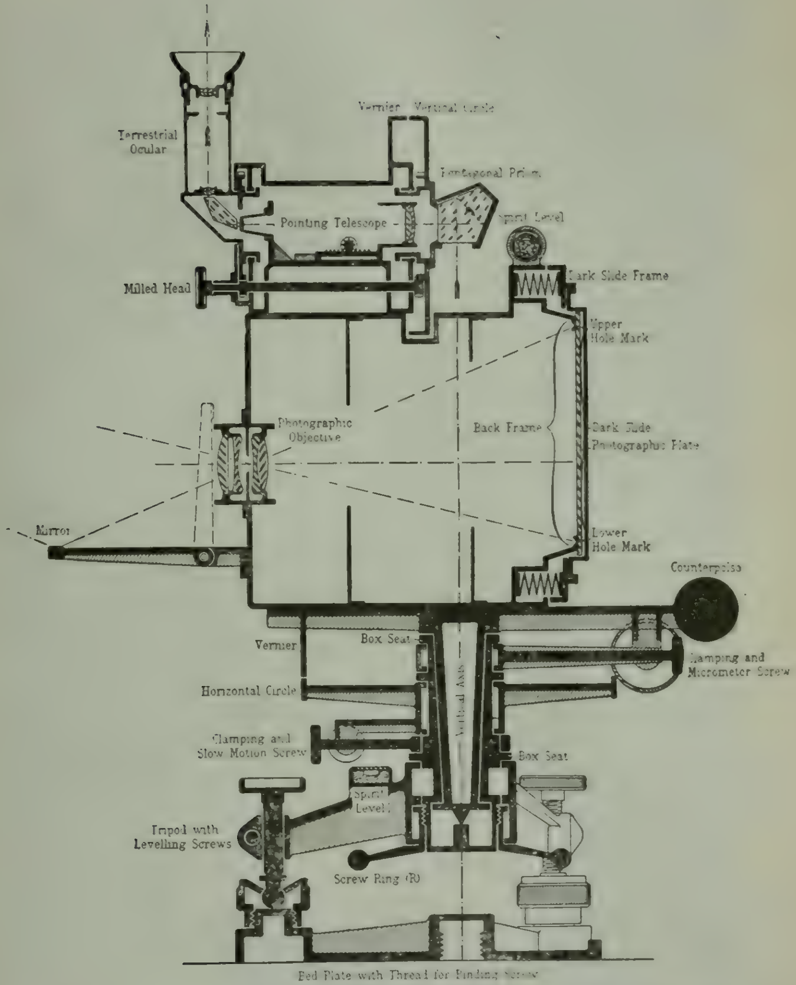


FIG. 20.

Showing 4 tripod arrangement.

PLATE XIII.



Diagrammatic vertical section through the Photo-Theodolite.
(The pointing telescope is drawn with the ocular in the vertical position).

PLATE XIV.

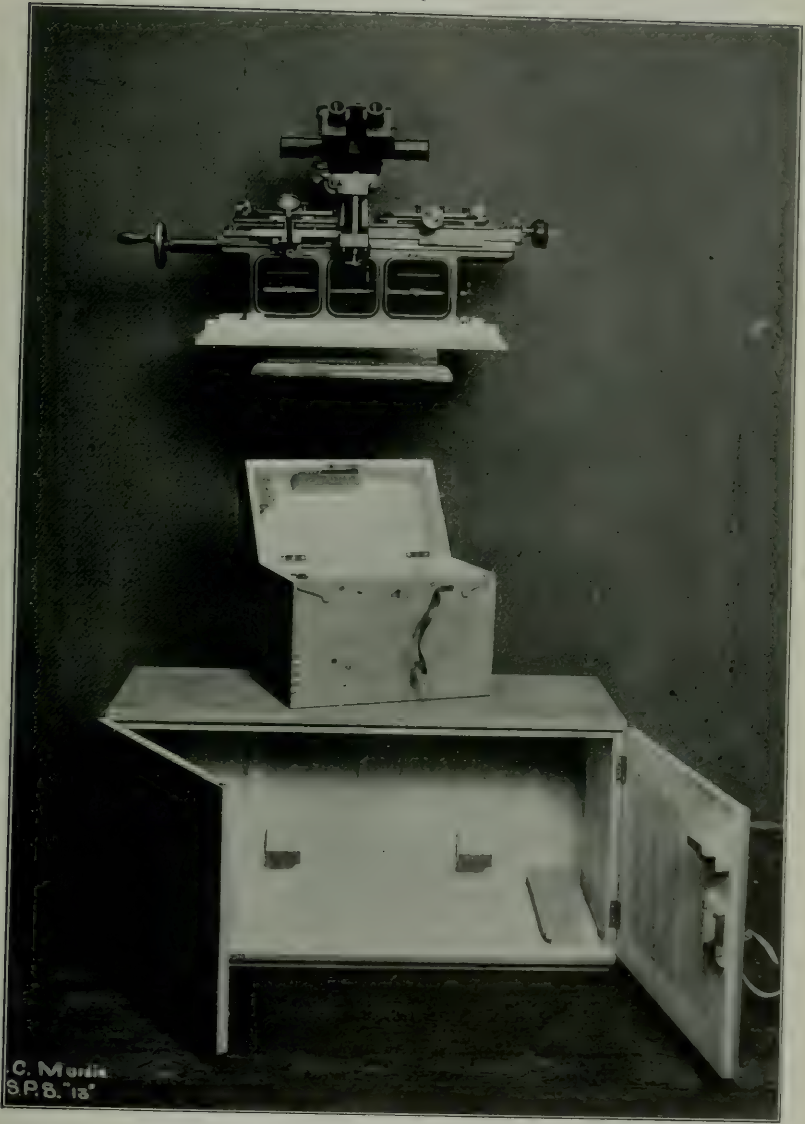


PLATE XV.

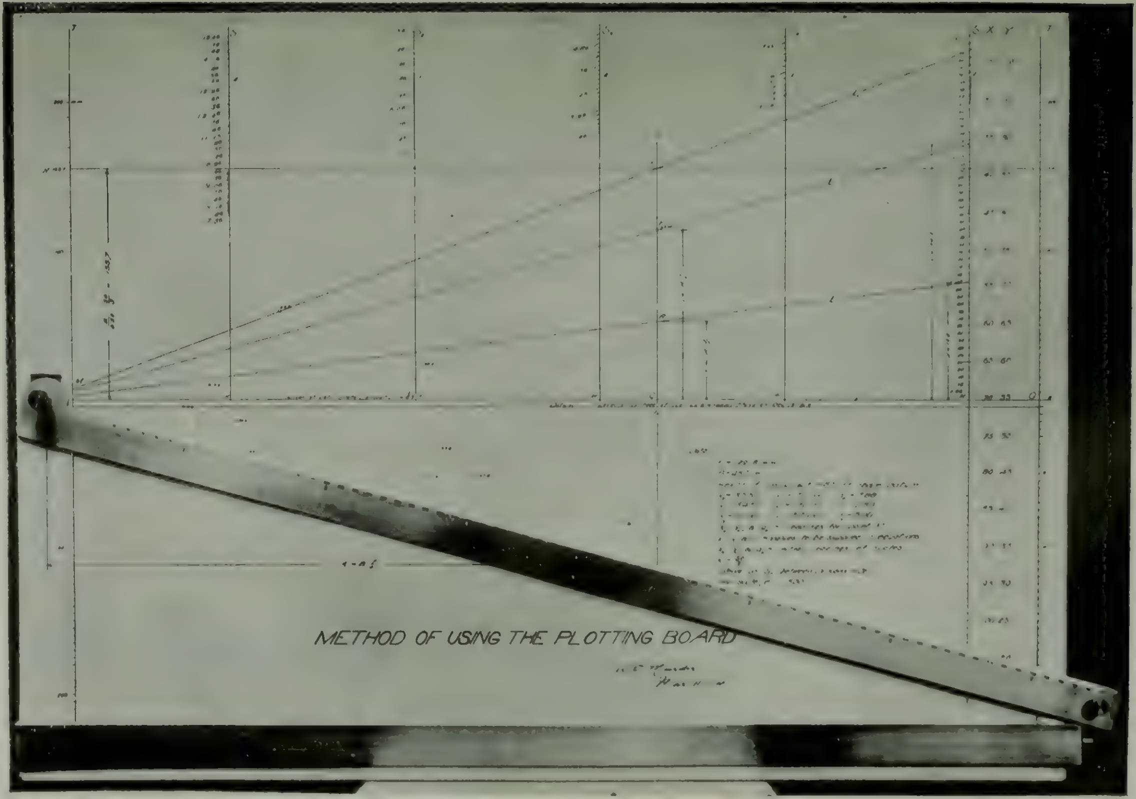
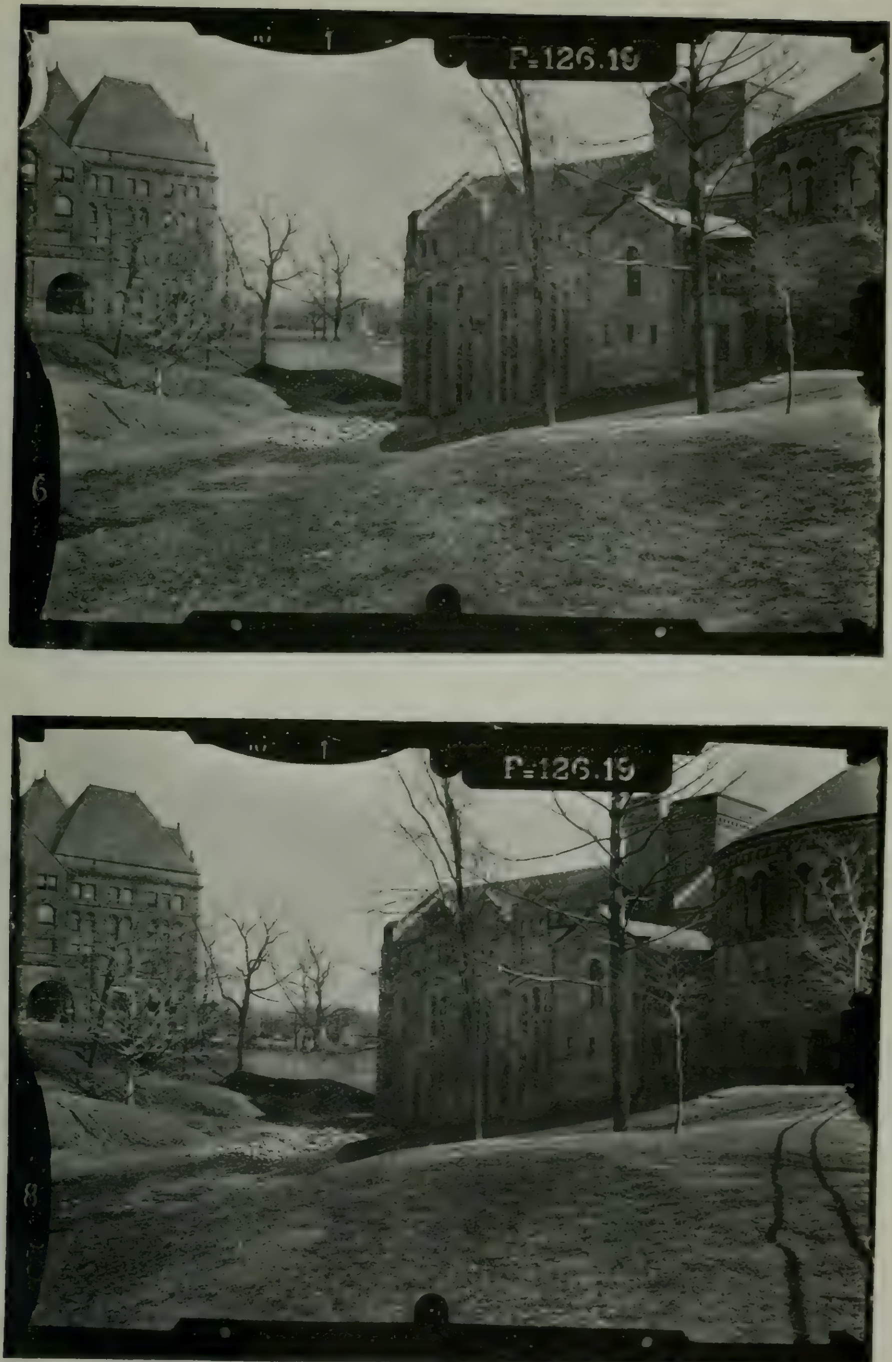
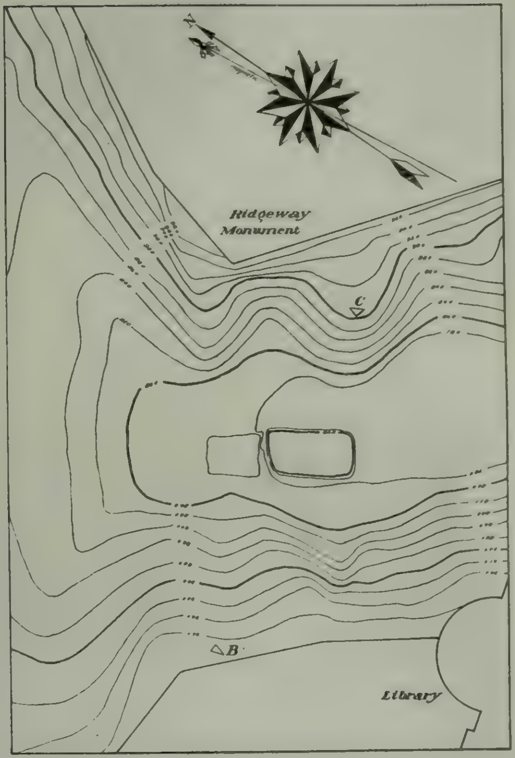


PLATE XVI.



SAMPLE PAIR OF STEREO-PICTURES.



STEREOPHOTOTOPOGRAPHICAL MAP OF RAVINE.

Datum....100 ft. below hydrant at Library.
Contour Interval....2 feet.
Natural Scale.......$\frac{1}{400}$

—Drawn by W. C. Murdie, April 9th, 1914.

APPENDIX.

The following is a description of the stereoautograph, taken from the Internationales Archiv für Photogrammetrie, 1911-13.

THE STEREOAUTORGAPH.

Capt. Ritter von Orel of the Austrian Military Geographical Institute, is the inventor of the stereoautograph. In the early stages of plotting the positions of points from stereophotogrammetry, the person doing the work was obliged to obtain data from photographs and substitute the results in the following formulae, to obtain numerical values of X_o, Y_o, and Z_o.

$$X_o = \frac{B}{P} \cdot x,$$

$$Y_o = \frac{B}{P} \cdot f$$

$$h = Z_o \frac{B \cdot y,}{P}$$

Next Dr. Pulfrich's plotting board, previously mentioned, was introduced and proved to be a great improvement with regard to speed and convenience. Later on the stereoautograph was invented. The latter eliminates the necessity of reading the different scales of the stereo-comparator by automatically plotting all desired points.

The Orel instrument which is used for the automatic valuation of the comparator comprises a stereo-comparator, a computing machine, and a mapping apparatus, all of which are connected in a suitable manner. Fig. 4 shows the detailed representation of the instrument.

The computing machine and mapping apparatus are joined up with the stereo-comparator by means of the three levers R, H, and P, and the couplings F_R, F_H, and F_P. The three designated levers serve for the graphical determination of the space coordinates.

The parallax lever P has the following ordinate $Y = \frac{b.\,f.}{P.}$

The direction lever R with the direction angle α has the abscissa $X = \frac{b}{P} \cdot x_1$

By use of the third lever H, that is the angle or elevation lever, the relative heights $\frac{h}{m} = Z = \frac{b}{P} \cdot y$, are obtained.

At J in Fig. 4, there is a scale on which the value of bn can be laid off for each pair of stereo-plates.

The points A, B, and C (Fig. 1.) are located on a line G G, parallel to the X axis of the comparator. The lever revolving about the point A controls the horizontal projections of desired points shown in the landscape on the left hand plate. A protractor placed at A gives the horizontal angle between a perpendicular to the left end of the base through A and any line connecting a point in the landscape with the left station. The striding guide F_R transmits motion to the lever arm AR. The distance travelled by F_R in a direction parallel to the long side of the plate is equal to the quantity x_1. Likewise F_H is a striding guide capable of revolving the arm BH through an angle equal to the elevation or depression of any point shewn on the left stereo-plate.

The fundamental distance formula of stereo-photogrammetry is $Y = \frac{b. f.}{p.}$

From Fig. 2, we see that this expression will give a very acute intersection. But if a suitable factor n is chosen the fundamental relations hold but the intersection angle is increased.

Let the scale of the map be 1: m.

Then let $b = \frac{B}{m.}$ where B = length of Base.

$$\therefore n\,b = n. \frac{B}{m}$$

The value of nb may be laid off on the scale JK_B for each pair of pictures.

From similar triangles (Fig. 1), the following relations may be derived.

$$P\,E = A\,E. \frac{x_1}{f} = \frac{b}{p} . x_1 = X = \frac{X_o}{m} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 1$$

$$M\,J = \frac{n.\,b.\,\frac{f}{n}}{p} = \frac{b}{p} . \; f = Y = \frac{Y_o}{m} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad 2$$

$$KF = Y\frac{y_1}{f} = \frac{b}{p} \cdot y_1 = Z = \frac{h}{m} = \frac{Z_\circ}{m} \quad \ldots\ldots\ldots\ldots\ldots \quad 3$$

Also $H = h_\circ + h$.
where H = elevation above datum
$h_\circ$ = H. I.

Fig. 4 shows the instrument to be provided with three hand-wheels situated along the lower side of the diagram. The left wheel moves the frame carrying the plates and gives the X co-ordinates, while the right hand wheel replaces the micrometer drum of an ordinary stereo-comparator and moves the right hand plate independently of the left plate to give stereoscopic effect. The central wheel controls elevations. The pin joints at A, B, and K_B are situated on a line GG, lying parallel to the horizon line of the plates, and are turning points for the three levers R, H, and P. The arm R traces the horizontal projections of desired points of the left hand plate, while the lever H gives their vertical projections. The movement of the arm acting through K is a magnified function of the parallax.

Fig. 4 shews the instrument set on a point in the left plate at a distance x_1 to the left of the principal line and at a distance y_1 above the horizon line. When the levers R, H, and P take the positions $R_\circ$, $H_\circ$, and $P_\circ$, the point sighted in the left hand negative is the intersection of the principal line with the horizon line. At this point parallax is zero. When an object is sighted the lever R gives the direction of the point P, while the lower arm of H gives the angle of elevation above the horizon. Thus we automatically obtain the horizontal and vertical angles of a point by merely setting the balloon shaped marks. But this only controls the direction of the point from A. The true position depends on the distance y.

To obtain the value of y we use the straight edge LL which travels backwards and forwards so that its edge is parallel to the line GG. A system of gears and worm screws controlled by the parallax wheel transmit LL to any desired position. On account of LL being parallel to the X axis all points contained in this line have the same parallax. A pencil at P plots the horizontal projection while a scale at K gives the relative elevation. If the scale is properly adjusted for the horizon the direct elevation above datum may be read off for each point.

If the clamp K_H is set at a desired elevation the contour at this elevation may be automatically plotted on the mapping board by means of the pencil P by starting at the left edge of the plate and by travelling across to the right. The operator merely keeps corresponding points of the same elevation properly superposed by revolving the left and right hand-wheels. To keep the quantity h constant, K_{II} travels up and down the line S.S. The operator need only watch the landscape through the eye-pieces, while his contoured plan is being mechanically built up by the pencil P.

In case the operator desires to lay off the contours on a print made from the left plate he fastens it in proper position to the immediate left of the left stereo. The slender rod extending from the Telemikroskop is tipped at P by a pencil which traces on the print a line joining all points of equal elevation sighted by the observer as the plate is viewed from its left to right edges.

The lower part of Fig. 5 shows a horizontal projection of the above contours made by means of a stereoautograph. This is a sample of the work done in the Ortler Mountains in Tyrol.

Stereophotogrammetry has a very promising future. The speed with which a survey may be made and completed justifies the use of this method above other methods. On one occasion durlng the Austrian Alps survey, an area of 20 kilometers square was completed with two days of field work and 16 hours of office-work. Two double stations were used. The horizontal scale of the finished plan was 1: 25000 with a contour interval of 20 meters in the lower parts ,and 100 meters in the higher levels. The Germans and Austrians have used this method in the Alps, and very satisfactory results have occurred. The English, French, Russian, German, and Austrian military authorities are using stereophotogrammetry in aeronautical surveying. Russia, Germany and Austria have used this method on the preliminary surveys of their government railways.

From the standpoint of an architect, stereophotogrammetry will be a great advantage in that from a pair of stereo-plates inaccessible heights and measurements may be made with great ease and rapidity. Surveys of historic ruins may be made, from which plans describing existing conditions may result.

Up to date very little is known on this continent regarding stereophotogrammetry, but there is scarcely any doubt but that as soon as it is as well understood here as it is in Europe, it will undermine the strongholds of the present methods of photographic surveying and will give creditable results.

W. C. MURDIE, M.A.Sc.

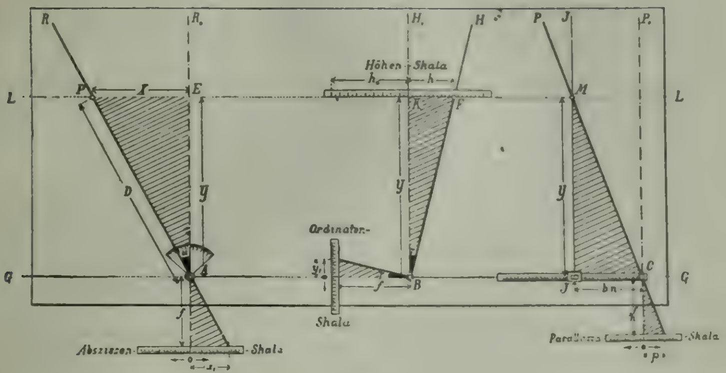
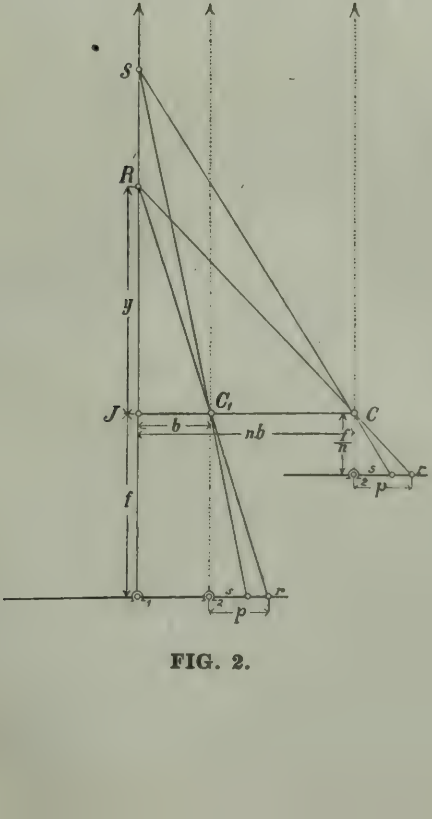

R
R₀
H₀
H
P
J
P₀
Höhen-Shala
h₀
h
L
P
X
E
K
F
M
L
D
y
y
y
Ordinaten-
Shala
G
A
y₁
f
B
C
G
J
bn
f
k
Abszissen-Shala
0
x₁
Parallaxen-Shala
p

FIG. 1.


S
R
y
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1
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s
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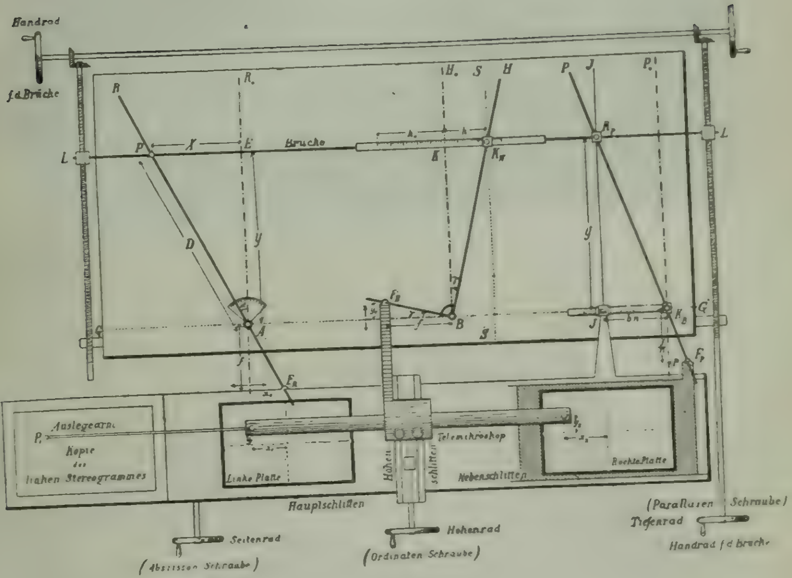
2

FIG. 2.


Handrad
f.d.Brücke
R
R₀
L
P
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E
Brücke
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y
A
f
x₀
F_R
H₀
S
H
K
K_H
F_B
y₀
γ
f
B
S
P
J
P₀
R_P
L
y
J
b n
K_B
G
F_P
Auslegearm
P₁
Kopie
des
linken Stereogrammes
x₁
Linke Platte
Höhen
schlitten
Teleml̈kroskop
y₂
x₂
Rechte Platte
Nebenschlitten
Hauptschlitten
Seitenrad
(Abszissen Schraube)
Höhenrad
(Ordinaten Schraube)
(Parallaxen Schraube)
Tiefenrad
Handrad f.d. Brücke

FIG. 4.

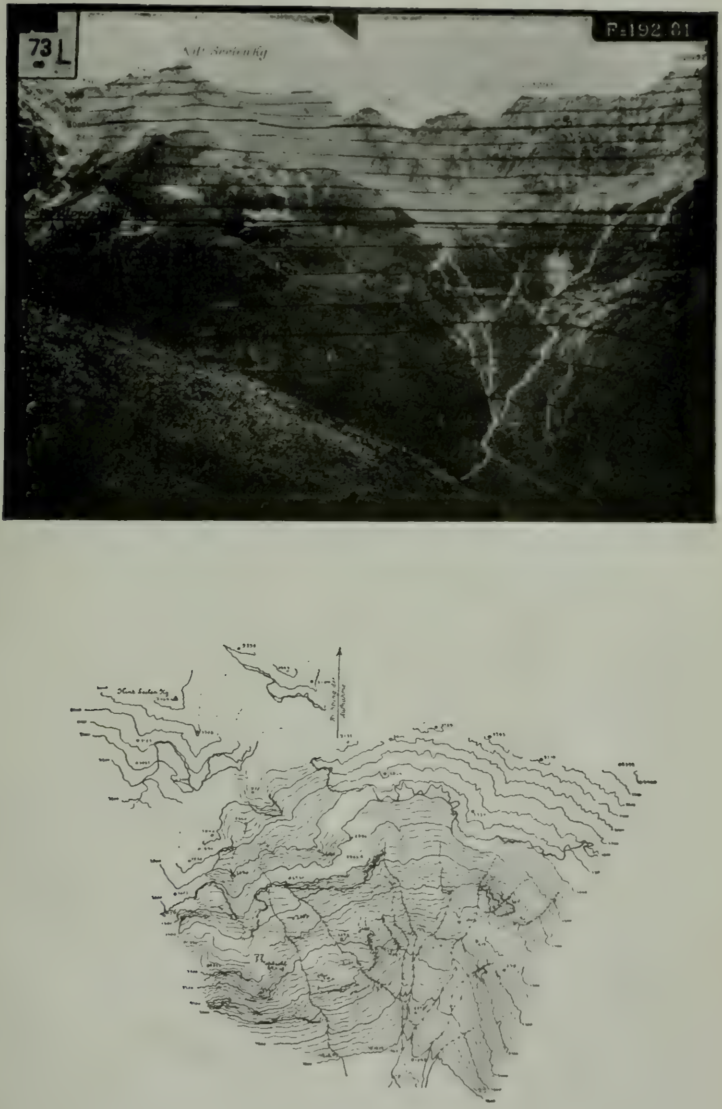


FIG. 5.

THE CHAIRMAN: Gentlemen, of course to most of us that paper is Greek. I have had no experience in this branch of the science. To those who have had experience it must have been intensely interesting, and I am sure that Mr. Murdie has gone to a great deal of trouble to prepare this paper for us. He is certainly entitled to our thanks.

A MEMBER: How long would it take, where you are taking a whole panorama of eight plates, to get the work done at the station?

MR. MURDIE: Ond day at least, possibly two.

MR. NELLES: Is the main advantage of this system accuracy or speed?

MR. MURDIE: I rather think both. The Germans have used it and anything they have used, I think, is worth looking into. They are looking for both speed and accuracy. It is used in the navy, one instrument being placed at the bow and one at the stern of a warship, so that it is possible within half an hour or so to have plotted the position of every ship on the horizon. It has been used throughout Germany and several European countries and it was also used in the location of the Bagdad railway. There is no doubt that speed and accuracy both come in.

A MEMBER: I was much interested in the paper because I have done quite a bit of photographic surveying in Alaska by the regular methods. Two years ago we were sent up the Gatineau to survey the pipe line for the city of Ottawa. We decided to make a topographical map of the drainage area and we did it by the making of plain table surveys of lakes and farms and photo surveys of the hills to get the contours. The country is a series of little knobs and dissected plateaux, it is all cut up. The hills are covered with trees and in order to get a view for the camera we had to cut down trees. I had read an article in connection with this work and I tried to size up the country to see how this system could be applied to it. I think it would work out very well if you wanted an accurate map, because anything you can see in your pictures you can plot. As long as a tree is visible you can plot it. There is no limit to the number of points you can get, but with the ordinary method there is. With the ordinary method it is hard to identify points. Many of our pictures were poor, it was hazy and we could not get good photographs. We spent a month or two, two parties, up there in the winter, and the photographs we then secured were a success and we are making a good map. But I think this method would work out in practical experience that you could do it much more quickly.

The Chairman: In what direction do you expect this system to be useful, in reconnaissances for railway purposes?

Mr. Murdie: For all topographical purposes that you would use in ordinary surveying.

The Chairman: For making contour plans of all kinds?

Mr. Murdie: Yes.

The Chairman: Is there much more work like that to be done in Alaska?

Mr. Murdie: In Alaska there is a good many thousand square miles to be done. The Boundary Commission have good maps of the coast district and for thirty miles back. They have a map six hundred miles long and four miles wide, along the 41st meridian, but the interior of Alaska is a big country, still unmapped.

The Chairman: There is evidently great possibilities for the work then?

Mr. Murdie: Yes, I should say so. The Alaska railroad men are making a contour survey through Alaska, over the routes of the various projected railways to find out which railway would be the best to run a road to the centre of Alaska to open it as a farming country, and they are making that survey along the same system as the 41st survey, running a triangulation as well, making a double survey.

Mr. Fawcett: We have a number of surveyors in Ottawa who have had experience with photographic surveys, but this is something new. I would move a vote of thanks to Mr. Murdie for his paper.

Mr. Jackson: I take much pleasure in seconding that motion.

Motion agreed to.

The meeting adjourned.

THURSDAY MORNING SESSION.

PLACER SURVEYS IN THE YUKON TERRITORY.

By F. H. Kitto, D.L.S.

For the sake of brevity in the title this article has been headed as above, though the expression "Placer Surveys" may be meaningless from a literary viewpoint. A more comprehensive title would be "A Synopsis of the Regulations Governing Placer Mining in the Yukon Territory, in so far as they concern the Surveys of Placer Claims, from 1894 to 1914."

Prior to the summer of 1894 it is safe to assume there is nothing to record that would be of interest in this discussion. While the Federal Regulations governing Placer Mining on Dominion Lands that were in force at that date were virtually in force in the Yukon, they were practically a dead letter, for the reason that the Government had no Officials on hand to enforce them. The Placer miners operating in the Yukon in 1894 were estimated to be about 250, of which about 200 were working on Forty-Mile River. So remote from civilization were they, and so small their production of gold, that until that date the Government had taken practically no notice of them. Hence claims were not recorded, fees and royalties were not paid and surveys were not required.

In 1894 the late Supt. (then Inspector) Constantine, of the Royal North West Mounted Police, arrived with a small detachment and established a post at the mouth of Forty Mile river on the left bank of the Yukon, about fifty miles below the present city of Dawson. In addition to his police duties, the Inspector was empowered to act as agent for the various Departments of the Government. As agent of the Department of the Interior it was his duty to receive and record applications for mining claims. It may be taken for granted that miners would lose no time in making safe their claims by recording them with the Inspector. With the putting into operation of the Mining Regulations there immediately arose objections to certain clauses therein, and from the year 1894 to the present time there has been a succession of alterations and amendments to these Regulations that is appalling.

The Regulations that were in force throughout Dominion Lands, and that were brought into effect on the arrival of the Inspector, were passed on November 9th, 1889, and styled "Regulations for the Disposal of Dominion Lands containing minerals other than Coal." The first point of interest to be noted herein is that shortly after the arrival of the Inspector the miners of the Yukon succeeded in having the Government amend these Regulations so as to increase the size of Placer claims in the Yukon. This is the first step in making different Regulations for the Yukon from the remainder of Dominion Lands. When the memorable Klondike rush took place, transforming the Yukon from a lonely camp of little significance to the most talked of mining centre in the world, it was felt that special Regulations were needed. Hence the old Regulations of 1889 were replaced in the Yukon by new ones passed on May 21st, 1897, coming into force July 3rd, 1897, and styled "Regulations governing Placer Mining along the Yukon River and its tributaries in the North West Territories." The Yukon was made a provisional district by direction of an Order in Council of December 18th, 1897. The Regulations of 1897, not working satisfactorily, were cancelled and new Regulations were passed on January 18th, 1898, coming into force March 5th, 1898, and styled "Regulations Governing Placer Mining in the Provisional District of Yukon." After three years experiment, during which time many alterations were made by Orders in Council, these Regulations were decided unsatisfactory and were replaced by new ones passed March 13th, 1901, coming into force April 17th, 1901, and styled "Regulations Governing Placer Mining in the Yukon Territory." These Regulations remained in force for five years, but not intact, as the usual frequent amendments to various clauses by Orders in Council were in evidence.

As it is not the purpose of this article to discuss the merits or faults of these various Regulations, it will be sufficient to state that so unsatisfactory to the Yukon miners did they prove, especially the frequent changes made without warning by Orders in Council, that a radical change was made in 1906. In that year a committee composed of the Commissioner in Council, the representative of Parliament, two of the Judges of the Territorial Court and a number of leading business men, mining engineers and miners of the Yukon, went fully into the matter of a Mining Code, and after much discussion and hearing the various views of several hundred miners, drew up and submitted to Ottawa a new Code which was passed as an Act of Parliament to take the place of existing Regulations. It was known as the "Yukon Placer Mining Act," passed July 13th, 1906, and came into force August 1st, 1906. Any amendment to this Act must, of course, come before Parliament, and thus the Yukon, through its representative there, has an opportunity to be heard before changes can be made. This Act has remained in force to the time of writing, January 1914, modified, however, by certain amendments made with a view of perfecting it in 1908, and again in 1912. At the present session of Parliament further amendments are being submitted, which, it is hoped, will overcome several difficulties in its working. With such continuous shifting of the Regulations it has kept the Placer Miner on the alert during the past twenty years to keep posted on his duties to the Government.

It is obvious that the Surveyor has had like need to keep posted. The proceedure in laying out a claim staked under the present Regulations would differ vastly from that of a claim staked under the Regulations in force in 1897. The size and form of a claim will depend on the size and form allowed by the Regulations that were in force at the time such claim was staked, subject to any extention of boundaries that may have been granted at a later date. Many claims staked in the early days are still in good standing. If called on to survey twenty claims, each of which had been staked in a different year during the past twenty years, a surveyor would find it necessary to make a very careful study of his Regulation file before proceeding with the field work.

It is the object of this article to set forth in the briefest manner possible a summary of such clauses in the Regulations as deal with matters affecting the survey of a claim. For this purpose reference is made only to such clauses in the Regulations and Act, and only such Orders in Council and Amendments as have a direct bearing on the matter. It is merely a sifting out of the volumes of official matter and arranging in chronological order for ready reference, the clauses of interest to the surveyor.

These notes will be arrayed under four headings, as follows:—

1. Nature and Size of Claim.
2. Discovery Claims.
3. Staking of Claims.
4. Advertisements of Surveys.

The terms used and the dates and authorities governing the various points mentioned under these headings will be given, also the gist of the Regulations. For more particulars the reader is referred to the printed copies of the various Regulations, Orders in Council, Act and Amendments, which may be secured from the Department of the Interior.

NATURE AND SIZE OF CLAIMS.

1889, November 9th. Regulations of November 9th.

"Bar Diggings"—100 ft. wide at high water mark, thence extending into the river to its lowest water level.

"Dry Diggings"—100 ft. square.

"Creek and River Claims"—100 ft. long measured in the direction of the general course of the stream, extending in width from base to base of the hill or bench on each side, when the hills or benches are less than 100ft. apart the claim shall be 100 ft. square, where they are more than 10 chains apart the claims shall be laid out in 10 acre blocks with boundaries north and south, and east and west, etc.

"Bench Claims"—100 ft. square.

1894, December 24th. Order in Council, December 24th.

"Creek and River Claims"—Length increased from 100 ft. to 500 ft.

1897, July 3rd. Regulations of May 21st.

"Bar Diggings"—Unchanged except clause added defining side boundaries to be parallel to each other and as nearly as possible at right angles to the stream.

"Dry Diggings"—Unchanged.

"Creek and River Claims"—Length unchanged (500 ft.) minimum width unchanged (100 ft.), width otherwise base to base of hills. Clause in former regulations limiting width to 10 chains, not mentioned.

"Bench Claims"—Unchanged.

1897, October 2nd. Order in Council of August 16th.

"Creek and River Claims"—Length reduced from 500 ft. to 100 ft.

1898, March 5th. Regulations of January 18th.

"Bar Diggings"—Not mentioned.

"Dry Diggings"—Not mentioned.

"Creek and River Claims"—Under headings "Creek and Gulch Claims" and "River Claims."

"Bench Claims"—Not mentioned.

"Creek and Gulch Claims"—250 ft. long measured in the general direction of the creek or gulch, bounded up and down stream by lines drawn at right angles to such direction and bounded in width by lines drawn on each side of the creek or gulch following rim or bed rock three ft. higher than the rim or edge of the creek or lowest general level of the gulch within the claim, providing, however, for a minimum width of 100 ft. and a maximum width of 1000 ft. on each side of the centre of the creek or gulch, should the rim lines be less than 100 ft. apart or more than 1000 ft. distant from the centre of the creek or gulch.

"River Claims"—250 ft. in length on one side only of the river, measured in the general direction of the river, bounded up and down stream by lines drawn at right angles to such direction, and extending in width from low water mark to a line following rim or bed rock three feet higher than the rim or edge of the river, within the claim, providing, however, for a minimum width of 250 ft. and a maximum width of 1000 ft. should the rim line be less than 250 ft. or more than 1000 ft. from the low water line.

"Hill Claims"--250 ft. in length drawn parallel to the main direction of the stream or ravine on which it fronts, extending at right angles from such front line to the summit of the hill, with a maximum depth of 1000 ft. should the summit exceed such distance.

"All Other Placer Claims"—250 ft. square.

1900, March 31st. Order in Council of February 20th.

"Creek and Gulch Claims"—Length unchanged (250 ft.), width changed from "Rim to rim, etc." to "1000 ft. on each side of the centre of the creek or gulch."

"River Claims"—Length unchanged, (250 ft.); width changed from "Rim, etc." to "1000 ft. from low water mark of the river."

"Hill Claims"—Length unchanged, (250 ft.); width changed from "Summit, etc." to "1000 ft."

"Enlargement of Boundaries"—Gold Commissioner authorized to grant to registered owners of claims acquired previous to this date, enlargement of the rear boundaries of such claims to the size defined by this Order in Council, provided such enlargements do not conflict with adverse claims.

1901, April 17th. Regulations of March 13th.

"Creek and Gulch Claims"—Length unchanged (250 ft.) except to be measured along Base Line of creek or gulch, established or to be established by a Government survey. Width changed from "1000 ft. on each side of the centre of the creek or gulch" to "1000 ft. on each side of the Base Line."

"River Claims"—Unchanged (Length 250 ft., width 1000 ft. from low water mark).

"Hill Claims"—Unchanged, except that front line must be parallel to base line of stream or ravine on which it fronts. (Length 250 ft. width 1000 ft.)

"All Other Placer Claims"—Unchanged (250 ft. square).

"Base Lines"—The Commissioner empowered to authorize, on behalf of the Government, the survey of Base Lines on rivers, creeks and gulches.

1905, October 7th. Order in Council of July 31st.

"Creek and Gulch Claims"—Length increased from 250 ft. to 500 ft.

"River Claims"—Length increased from 250 ft. to 500 ft.

"Hill Claims"—To be included in "All other Placer claims."

"All Other Placer Claims"—Length increased from 250 ft. to 500 ft. and width to be 1000 ft.

1906, August 1st. The Yukon Placer Mining Act of July 13th.

"Creek Claims"—Unchanged. (500 ft. by 1000 ft. on each side of the Base Line).

"Gulch Claims"—Not mentioned.

"River Claims"—Not mentioned.

"All Other Placer Claims"—Unchanged. (500 ft. by 1000 ft.) those fronting a creek to have their frontage parallel to the Base Line of the creek.

"Enlargement of Boundaries"—Gold Commissioner authorized to grant enlargement of Boundaries of any claim for which a grant was issued prior to this act to the dimensions of such claim as allowed if staked under this Act.

"Base and Side Lines"—Side lines of claims on a creek, as well as Base Lines, provided for.

1908, July 20th. Amendments of July 20th.

"Creek"—Defined as natural water course whether usually containing water or not.

"River"—Defined as stream having an average width of 150 ft.

"Creek Claims"—Unchanged. (500 ft. by 1000 ft. on each side of Base Line).

"ALL OTHER PLACER CLAIMS"—Mentioned as "Claims situated elsewhere than on a creek." Unchanged, (500 ft. by 1000 ft.) To conform to Base Line of river or creek which they face.

"ENLARGEMENT OF BOUNDARIES"—To apply to any claim instead of claims for which grants had been issued prior to the passing of the Act.

"BASE AND SIDE LINES"—Provision for Base and Side Lines made to include rivers as well as creeks.
1914, January. No further changes.

The abbreviated form given below has been used by the writer as an index in checking returns of surveys of Placer claims and will serve to illustrate at a glance the complications of the Placer Regulations.

CREEK CLAIMS.

November 9th, 1889, to December 24th, 1894.
Length.................. 100 ft.
Width...................Base to Base, etc.
December 24th, 1894, to October 2nd, 1897.
Length.................. 500 ft.
Width...................Base to Base, etc.
October 2nd, 1897, to March 5th, 1898.
Length.................. 100 ft.
Width...................Base to Base.
March 5th, 1898, to March 31st, 1900.
Length.................. 250 ft.
Width...................Rim to Rim, etc.
March 31st, 1900, to April 17th, 1901.
Length.................. 250 ft.
Width...................1000 ft. on each side of creek.
April 17th, 1901, to October 7th, 1905.
Length.................. 250 ft.
Width...................1000 ft. on each side of Base Line.
October 7th, 1905, to Date. (January, 1914).
Length...................500 ft.
Width...................1000 ft. on each side of Base Line.

DISCOVERY CLAIMS.

The various regulations have made provision for granting claims of extra dimension, to be known as "Discovery Claims," as a bonus to the original discoverers of new mines. It has come to be the practice to allow one discovery to a creek.

1899, November 9th. Regulations. Section 18 (f) (in part).

"To one discoverer, a claim 300 ft. long; To a party of two, a claim 600 ft. long; To a party of three, a claim 800 ft. long; To a party of four, a claim 1000 ft. long; To each member of a party beyond four in number, a claim of the ordinary size only." (100 ft.)

1894, December 24th. Order in Council.

While the length of ordinary claims was increased from 100 ft. to 500 ft. no mention was made of Discovery claims.

1897, July 3rd. Regulations.

A discoverer is allowed "A claim for Bar Diggings 750 ft. in length." This was evidently intended to apply to any claim, and not Bar Diggings only.

1897, October 2nd. Order in Council of August 16th.

Length of Discovery claims reduced from 750 ft. to 200 ft.

1898, March 5th. Regulations of January 18th.

Discovery claims on a creek, river or hill provided for, "To one discoverer, one claim 500 ft. long; To a party of two, two claims, together 1000 ft. long; To each member of a party beyond two in number, a claim of the ordinary size only."

1900, March 31st. Order in Council of February 20th.

Discovery clause amended. "By giving to one discoverer a claim of 1000 ft. in length, and to a party of two discoverers, two claims amounting together to 1500 ft. in length."

1901, April 17th. Regulations of March 13th.

No change.

1906, August 1st. The Yukon Placer Mining Act, of July 13th.

Sec. 12 "Any person or party of persons locating the first claim on any creek, hill, bench, bar or plain, or locating a claim on any hill, bench, bar or plain upon which there is no recorded claim, shall be entitled to a claim or claims respectively of the following size, namely:— To one locator, one claim, 1500 ft. in length; To a party of two locators, two claims, each of 1000 ft. in length; To each additional member of a party beyond two in number, a claim of the ordinary size only."

1908, July 20th. Amendments of July 20th.

Length of the two claims allowed a party of two locators increased from 1000 ft. each to 1250 ft. each.

To a party beyond two in number no change was made, the party being allowed "two claims, each 1000 ft. in length, and for each member of the party beyond two, a claim of the ordinary size only."

It is interesting to note that the word "Discoverer" was replaced in 1906 by the word "Locator." In the revision of Statutes in 1906, section 12 had its number changed to 26. The expression "Discovery claim" is still used locally though it should be, strictly speaking, "Location claim." Discoveries are no longer necessary.

STAKING OF CLAIMS.

1889, November 9th. Regulations.

The Regulations governing the staking of Quartz claims were made to apply to Placer claims. These Regulations called for a post at each corner of the claim, with the boundaries of the claim cut out if in woods, and marked with additional posts if in uneven country. In addition the placer Regulations required that creek or river claims should have both end boundaries posted where they crossed the creek or river, at high water mark on both sides. It thus required at least eight posts to stake a creek or river claim. The Quartz Regulations called for wooden posts not less than 4 inches square, driven at least 18 inches into the ground and showing that distance above it, or mounded, if posts could not be driven, by stone cairns at least 3 feet in diameter at the base and 18 inches high. Instructions were given for marking all the corner posts of a quartz claim in rotation. The Placer Regulations required that all the posts of a claim should be marked with the claimant's name and the date of staking, but did not define how the eight posts of a creek or river claim should be numbered.

1897, July 3rd. Regulations of May 21st.

"Legal Post" was defined as "A stake standing not less than four feet above the ground and squared on four sides for at least one foot from the top. Both sides so squared shall measure at least four inches across the face. It shall also mean any stump or tree cut off and squared or faced to the above height and size." The number of stakes required and their location remained the same as before, but the locator was required to mark one post only, with his name and date. In creek, river or bar claims this post was to be one of the posts placed at high water mark.

1898, March 5th. Regulations of January 18th.

Claims were to be staked by two legal posts, each post bearing notice stating the name or number of the claim, its length in feet, date when staked and full name of the locator. The line between the two posts was to be opened up if in woods. Creek claims were to be staked along the general direction of the valley, and river claims along high water mark. Hill and other claims required staking along the front.

1901, April 17th. Regulations of March 13th.

Base lines on gulches, creeks and rivers being provided for under these Regulations, instructions were added requiring that claims staked on gulches, creeks or rivers should be staked along the Base Lines thereof, or should conform to the Base Lines thereof when such were established. The staking of hill and other claims was also required to conform to lines parallel to the Base line towards which they fronted. It was also set forth that the location stakes of a claim should be numbered 1 and 2 and should the distance between them exceed the length allowed by the Regulations, a Dominion Land Surveyor was permitted to move back stake No. 2 to the proper distance. These instructions remain unchanged at the time of writing.

ADVERTISEMENT OF SURVEYS.

The practice of advertising surveys of placer claims was introduced in 1900 by Order in Council. When it is borne in mind that Crown Grants in perpetuity are not issued for placer claims, but that placer grants are good for one year only, with provision for yearly renewal, the advantages of the provisions for advertising will be obvious. The decisions of the Courts in protested cases are a great advantage also in throwing light on the interpretation of the Regulations. The exact text of the Order follows:—

1900, March 2nd. Order in Council.

"Surveys of claims already made by a Dominion Land Surveyor either employed by the Dominion Government or by the miners themselves, shall, if approved by the Commissioner of the Yukon Territory, and after a notice of such survey being advertised for three months in one of the newspapers published at Dawson, if unprotested, be made to define absolutely the boundaries of the claims surveyed: and if at any time a holder of a claim should wish to have his boundaries defined, he may employ a Dominion Land

Surveyor to make a survey thereof, and after publishing a notice in the manner above mentioned, such survey shall define the boundaries of the claim surveyed. If within three months from the time such survey is published, the survey is protested, the protest shall be heard and decided upon by the Gold Commissioner. The surveys of all claims shall be made under instructions from the Commissioner of the Yukon Territory and approved by him before they can be accepted as defining the boundaries of the claims surveyed." The full text, though lengthy, has been quoted as it is self-explanatory. Though several minor changes have been made since, the essence of the Order is still in force.

1901, April 17th. Regulations of March 13th.

The Order in Council quoted above was embodied in Section 46. The wording was altered and a few changes made which might be noticed. It was enacted that such advertisements should appear in the "Yukon Official Gazette;" That protests should be made within the time such notices were being published; that before inserting such notice in the Gazette, the owner of a claim should post on a conspicuous spot on his claim a notice of his intention to advertise the survey thereof together with a copy of the surveyor's plan of such survey; that should a decision be rendered varying the boundaries of a claim from those defined by the advertised survey, a resurvey might be made according to the decision and fresh returns thereof approved by the Commissioner and accepted without further advertisement; that base line surveys should be subject to advertisement and protest.

1906, August 1st. Yukon Placer Mining Act of July 13th.

Section 46 of the old Regulations became Section 25 in this Act. A few slight changes might be noticed. The authority of the Commissioner in this connection is extended in the words "Or an Official appointed by him for that purpose" (The Director of Surveys); the clause relating to Base Line surveys being subject to advertisement and protest was dropped. In the revision of Statutes of 1906, Section 25, of the Yukon Placer Mining Act became Section 39, and Section 26, dealing with Base Lines, became Section 40.

1908, July 20th. Amendments of July 20th.

Section 39 was amended by adding a clause providing for appeals from the decision of the Gold Commissioner to the Territorial Court of the Yukon Territory. Section 40 was amended by again making Base Line surveys subject to advertisement and protest.

No further amendments have been made to date. The Yukon Official Gazette is no longer published as an entire gazette but consists now of such portion of page six of the "Dawson Weekly News" as may be required by the Yukon Territorial Government for advertising.

The abbreviated and irregular notes as arranged under the preceding four headings fall far short from giving a comprehensive grasp of the difficulties of understanding or administering the Placer Regulations during the past twenty years. They deal with surveys only, whereas less than one-tenth of the entire Regulations are devoted to this subject. But they serve to illustrate forcibly that the great fault of the Regulations has been their lack of permanency. A few remarks before closing, deduced from personal experience, during the past three years in the Yukon, may not be out of place.

This lack of permanency has two great and serious drawbacks to answer for. Firstly, it is discouraging and confusing alike to the miners and prospectors, and to the Government Officials who are called upon to administer the Regulations, as well as to the surveyors. In the putting into operation of a set of Regulations there are always points of more or less importance to be adjusted. Difficulties in interpreting clauses must be overcome. Disputed versions of the meaning of certain terms and expressions used will constantly arise. In time these become more settled by office rulings or from views contained in judgments rendered when disputed cases have found their way into Court. Thus in time a sort of fixed understanding of the Regulations comes about, which gradually spreads to the most outlying portions of the Territory. Suddenly word comes from Ottawa that changes have been made and before the public can adjust itself to these changes more changes are made. Professional and business men about town may follow the frequent changes, but the miners and prospectors in the hills are constantly in the dark. Secondly, it is discouraging to the capitalist who considers placer investments. To induce capital into the field one must be able to show a likelihood of permanency in the Regulations as well as in the undertaking. The Yukon needs capital and offers large returns. The days of fabulous wealth for the individual miner may, or may not, be past, but there are vast areas of lower grade ground that can be worked on a large scale to yield vast profits.

With more particular reference to the subject under discussion, namely, surveys, a few points might be touched upon briefly. The Regulations of 1889 and of 1897, which might be spoken of as "Base to Base" Regulations, give great difficulty to the surveyor in defining the base of the hill. No two surveyors can reasonably be expected to survey lines to mark the base of the hill that will exactly agree. If a placer claim were surveyed first and then offered to a miner, as a quarter section is surveyed and offered to a homesteader, then a surveyor could reasonably be asked to make the base of the hills the side boundaries of the claim. The surveyor could use his own judgment and if the miner did not like the look of the claim as so surveyed he need not take it. But one miner secures a grant for a creek claim and another miner a grant for a bench claim adjoining one of its side boundaries. A surveyor is called upon by the owner of the creek claim to survey his claim. The owner of the bench claim thinks the survey of the creek claim is encroaching on his boundaries and calls another surveyor to lay our his bench claim. Each surveyor, naturally, interprets the base of the hill in favour of his "client," if such word may be used, and an over-lapping of surveys occurs, which usually ends in litigation. With mathematical boundaries in place of natural boundaries such state of affairs could not happen.

The "Rim to Rim" Regulations of 1898, may, in theory, have been thought to overcome the "Base to Base" difficulty, but in practice they were impossible. A surveyor might, by adding a level and a Keystone drill to his equipment, make a try, but a safer plan would be to ground sluice the entire claim off to bedrock before attempting a survey.

The change to "1000 ft. on each side of the creek or gulch," made in 1900 and embodied in the Regulations of 1901, was a move in the right direction, but it still left the surveyor to determine the centre of the creek or gulch. This becomes a difficult task when the survey is not made for several years after the claim has been staked, especially if mining operations have been in progress. The bed of the creek may have been entirely changed from natural or artificial causes in the meantime.

The mathematical boundaries as set forth in the Yukon Placer Mining Act of 1906, are decidedly more satisfactory than former boundaries depending on natural features. There are still drawbacks which can only be fully realized when one is called upon to act. Of these only three will be referred to here.

(1) A creek forks, a base line is run up each fork, a miner stakes a claim on one fork a short distance up from the forks, and his claim being "1000 ft. on each side of the base line" may extend across the other fork, thus giving him two lengths of paystreak, each the full length of a claim, one on each creek. (2) A small creek runs into a larger one at right angles to it. The paystreak of the

larger creek, which has a wide valley, is along the edge of the valley on the side on which the smaller creek enters. A miner stakes a claim along the smaller creek, in the valley of the larger one, so that his claim of "1000 ft. on each side of the base line" (of the smaller creek) will include 2000 ft. of the paystreak of the larger creek, whereas the intention is that such paystreak should be staked in claims of 500 ft. only. (3) An angle occurs in a base line. The treatment of claims in the vicinity of such angle gives rise to much discussion. The latter of these difficulties is in reality the only one that need seriously concern a surveyor, as in the others he simply surveys the claim according to the miners' grant regardless of paystreak lengths. The watchword of the surveyor in examining grants must always be most emphatically "Priority."

The history of base line surveys is also interesting. As yet no official definition of a base line has been given though the writer has submitted the following to be included in the proposed amendments of 1914: " 'Base Line' means a traverse line following the general direction of the bottom lands of the valley of a creek or river, surveyed and established by authority of the Commissioner, and governing the boundaries of claims adjacent thereto." The Regulations of 1901 gave the Commissioner power to authorize such surveys, and made them subject to advertisement and protest. The Placer Mining Act of 1906, dropped the advertisement and protest clause and provided (Sec. 24 revised statutes) that the official survey of a base line should be a "final determination" of such base line. The amendments of 1908 reinstated the clause relating to advertisement and protest (Sec. 40), but allowed the "final determination" clause of Section 24 to remain. This appears an absurdity. The provisions for advertising the survey of a base line appears only reasonable, but making such Government survey subject to the protest of any irresponsible person appears unnecessary. Though base lines were first mentioned in 1901, many traverses of streams surveyed previously have been accepted as base lines, apparently without any official declaration. These include, among others, traverse surveys on Eldorado and Bonanza Creeks by the late William Ogilvie, D.L.S., the pioneer surveyor of the Yukon, in 1897. The question has arisen whether or not it is necessary to have some official declaration or advertisement made to establish such traverse lines as were run prior to 1901 as legal base lines.

With so many changes in mining Regulations, and so many loop holes in them, it is little wonder that the Yukon has witnessed endless litigation, especially when so much of the ground was fabulously rich. When one considers that a "bench claim" of

1897, that is a plot of one hundred feet square, has yielded Eighty Thousand Dollars it can readily be understood that the demand on the surveyor for precise work is urgent. The combination of much litigation, rich ground, deep valleys and high hills, shafts and tunnels, and extremes of weather have demanded a high standard of work from Yukon surveyors. It might be of interest to add that feet and tenths have become the standard of measurement in the Yukon and chains and links are scarcely ever mentioned.

In conclusion it might not be out of order to suggest that a consideration of the discussion herein will convince one of the advisability of requiring pupils articled to Dominion Land Surveyors to acquaint themselves more thoroughly with the nature of the various surveys other than township surveys that they may be called upon to undertake later in life. On the assumption that a Dominion Land Surveyor will spend his whole professional career on surveys pertaining to the various systems described in the Manual, either on salary or by contract for the Government, the present requirements of qualifications may be sufficient. But on the assumption that he will engage in private practice and possibly never work a single day directly for the Government, it is evident that he stands a great chance of being commissioned and set free to run his career before he can even walk. Ought not his education as a surveyor be made more comprehensive so that he will realize the importance and know the details of the various duties he may be called upon to perform, and the various questions he may be called upon to expound, in his capacity as a professional practicioner?

F. H. KITTO, D.L.S.
Director of Surveys, Yukon.

DAWSON, YUKON,
JANUARY, 1914.

MR. FAWCETT: I did not hear the first part of the paper, but I can perhaps as well as anybody realize the difficulty which arose from the surveys in the Yukon, especially from such terms as Rim-rock, and the different regulations which arrived at different periods, passed by Order in Council, which naturally would become law at the time they were passed, but which would not reach the Yukon for three or four months afterwards. It can easily be understood what difficulty and litigation would arise from such conditions. With reference to the creek claims in the early days before there were any surveys made in the country, the people made the surveys themselves, they staked their claims and in staking up the creek they generally followed the stream itself, five hundred feet. When they staked the Bonanza and El Dorado the claims were five hundred feet in length, extending from base to base of the hills. The men when they staked the claims followed the stream. Mr. Ogilvie made a survey of the Bonanza in the winter of 1897, and he found a good many of those claims were cut out, people staked along the stream, but the stream would take a turn and where the loop occured in the stream one claim would be cut out (illustrating on the blackboard) there was a good deal of dissatisfaction from this cause, a man would stake a claim in good faith just as others had done and then he would be cut out of his claim and of course he thought he had a grievance, but that could not be helped.

Another condition that arose and gave trouble in settling was owing to the base line. The only way people had when they came to stake on the hill side was from the base line. The regulations did not define any way of describing claims on the hill side so we adopted the method of having people measure the upper claim parallel to the base line as they have done on the gulch in tiers. The one at the base of the hill would be the first tier and the next the second tier and so on until they got five, six, seven and eight tiers from the base line. The size would then be only one hundred feet. The creek claims were five hundred feet. As a rule those who measured claims measured them too long and when the surveyor came along he cut off the five hundred feet so between that claim and the next claim there would be a fraction.

Mr. Brownlee: Tell about the fraction.

Mr. Fawcett: There was one fraction of seventy feet on the El Dorado belonging to a Mr. Barney, where Mr. Ogilvie panned the famous $600.00 pan on the dump. That was one of the things that caused all the exaggeration as to the value of Yukon claims.

In reference to the base of the hill, as Mr. Kitto stated, when Mr. Ogilvie was laying out those claims, the base line, he followed the direction of the creek in one direction and then in another. At each point of change of direction he split the angles by drawing a line across so as to mark the end of the claim. (Illustrating on the blackboard). A man in locating a placer claim described it in such a direction from the base line. But some claims would be properly described from two points, two different points, owing to this splitting of the angles, and that would cause litigation. I had some trouble to get the judge to understand how two persons could properly describe a claim from two points on the base line. It all depended on the stake. People paid no regard to the stakes at first. A man would cut another man's name off the stake and put his own on and then a third man would come along and cut his off. They paid no regard to each others stake, so that when matters were in litigation they had to be decided on other points. There was a good deal of trouble through the gulch claims. They were at that time five hundred feet long and one hundred feet wide. There was nothing in the regulations to say exactly that the creek should be the middle of the one hundred feet; it might be, as I interpreted the regulations, on one side. Sometimes the pay streak would go under the point of a jutting hill and the man having a gulch claim would want to follow his pay streak. Another man finding that the pay was going into the bank would locate a claim at once on the bank, and the man on the creek would put in a protest that this man was on his claim. The only way I could think of deciding a question of that kind was in this way. Mr. Gibbon was the surveyor. We gave the gulch creek man one hundred feet on the side of the creek. It was contended that we had no authority to make a survey in that way. I told the man who was digging on the hill that he must not dig within that line, that is, the one hundred feet. If he did the man who owned the gulch claim might win out in court. But if the man on the hill went outside of that one hundred foot line he was quite safe. They went inside and I do not know whether they ever settled the litigation or not. When Mr. Ogilvie was surveying these claims he placed the post sometimes on the hillside and sometimes a piece back on the front. When hill claims came to be valuable, the man on the creek claimed up to the post. I had to throw out any posts on the hillside because they were past the base of the hill and in that way we had a good deal of difficulty. Anyhow, in my interpretation of the Act, I was upheld by the Department in all cases. Those are some of the difficulties that we encountered with the surveys of the Yukon.

Mr. Brownlee: I must say that I think Mr. Kitto is a very modest young man. If I had been the author of that paper I would have been very proud to read it and I think Major Hubbell should have insisted on the author reading it. I think Mr. Kitto has laid down a basis for better conditions for surveyors in the future. He has handled the subject in a good, clean, clear-cut way. It is really delightful to me to find young men like Mr. Kitto and Mr. Dennis and Mr. Neelands who are thoroughly technical and who know their work and do not have to go to the lawyer, who in fact can teach the lawyer. The lawyers will take up these very things and be the big fellows and get the rake-off and all the kudos, when in reality they have stolen all of their information from the surveyors. In many large cases that go into court the lawyers absolutely rely on the surveyors, and who gets the money? The surveyor gets his $10, $20 or $30 a day and the lawyer gets his $150, and it is not uncommon in land litigation for a lawyer to get $150 to $500. I have been a witness in a case and sat side by side with lawyers who were getting $500 a day and I was not getting much more than 5% of that. We have men like these young men who go into these things and really become teachers of the lawyers, and I think we should be very grateful to them. I have always said in British Columbia that we should try and take some of this work out of the hands of the lawyers and become our own lawyers, and have the clients appealing to us instead of appealing to the lawyers, because inevitably the lawyers are the fellows who will get the money. I have very much pleasure in seconding the vote of thanks to Mr. Kitto for the painstaking, able paper he has delivered. I am sure there is no one in the room who will benefit by it as much as I will as his successor. The paper read by Mr. Neelands will be a great help in connection with some future work, and I am really glad, after thirty-five years away from Ottawa, to come back and find that we have such able young men in the profession who are leaders and will do good for our country.

Motion agreed to.

The Chairman: If there is any one profession whose membership should be called honourable it is the surveying profession. The whole life and work of a surveyor is similar to that of a judge. Lawyers and doctors may get the big fees, but the surveyors do the work. I was looking at some questions in the Ontario Land Surveyors' Drawer, questions of law, adverse possession, line fences, questions on which the surveyor must be an expert as well as in mathematics. The surveyors must be familiar in Ontario with the Ditches and Water Courses Act, the Dominion Land Surveys Act, the Yukon Act and all of these different pieces of legislation. In all these things the surveyor must be an expert or he will fall by the wayside. It was suggested byMr. Kitto that such subjects as Placer law should be included in the Act. It is only a question of the education that the surveyors should have. The surveyor will come to his deserts after a while and the young men who have read these papers are the forerunners of that condition.

Motion of thanks agreed to.

LABORATORIES OF THE DOMINION LANDS SURVEYS.

By W. C. Way.

A general description of the work carried on by the Surveys Laboratory in testing and standardizing field instruments may be of interest to Dominion Land Surveyors. With this idea in mind the following paper has been prepared, giving a brief account of the laboratories and some of the principal operations.

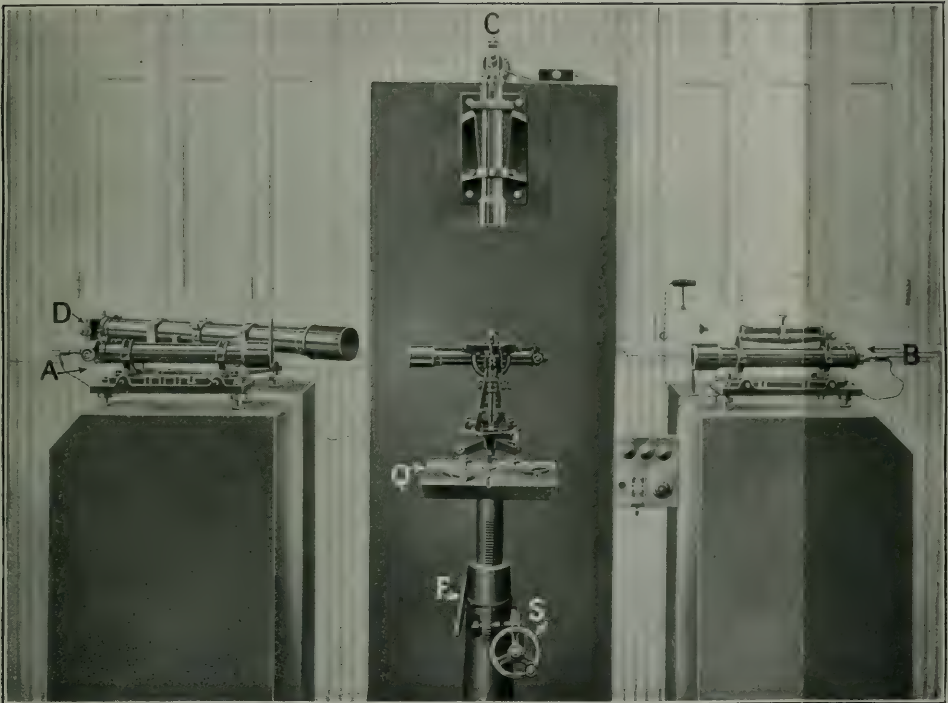


FIG 1.

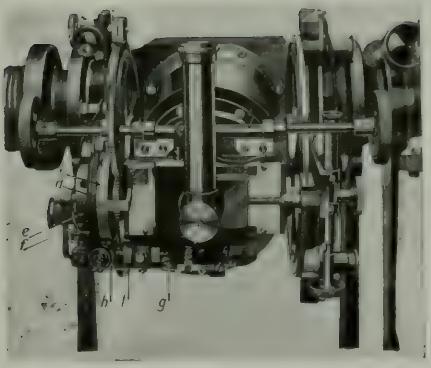


FIG. 2.

In 1885, a small observatory was erected on Cliff Street, Ottawa, for longitudinal determinations by telegraphic exchange of time: it was afterwards used by surveyors in practising astronomical work. Owing to the large number of surveying instruments distributed through the office of the Surveyor General, and the special nature of the operations involved in extending the D.L.S. system, it became necessary to secure means for examining, testing and adjusting these instruments and determining their constants. A small building specially designed and equipped for testing transits, levels, etc., was erected close to the old observatory. At the same time a new observatory was built, this being used by surveyors for practising azimuth and latitude observations.

The observatory is connected with the laboratory by means of a long corridor in which formerly tape comparisons were made, but which is now equipped with means for testing telescopic objectives. In the laboratory there are two rooms in general use, one an office, and the other the test room. The walls of the test room are double, each 8″ thick with a 4″ air space between, and the windows have latticed shutters on the outside and solid shutters inside. There is a ventilated loft over this room, mineral wool being used between the floor of it and the ceiling of the testing room. The temperature varies very little in the course of a day's work. The foundations are carried down to solid rock, and concrete piers are built up from the rock to support the various apparatus, so that the setting shall not be easily deranged.

The equipment consists of horizontal and vertical collimators, a level trier, a standard barometer, air pump, and apparatus for testing aneroids, temperature boxes and sidereal clock for watch trials and for use in conjunction with the clock, a chronograph and astronomical transit. Three chronometers, various micrometers and microscopes with other subsidiary apparatus are also included in the equipment.

There are four collimators. Fig. (1) gives a good idea of their general arrangement. The two horizontal collimators A. & B. on opposite sides of the test stand are accurately in line and level, and are used principally for adjustment of the line of collimation and level bubbles. The third, marked "C" on photograph is in the same vertical plane as the first two and vertically above the centre of the testing stand. It is used for determination of pivot inequalities and in conjunction with the horizontal collimators for testing the vertical circle. The fourth collimator "D" is horizontal and makes an angle of 30° with the first. This collimator is fitted with an excellent micrometer screw used for calibrating the eyepiece micrometer on base line transits, for the determination of the interval of stadia wires and of the values of the divisions of level bubbles, for measuring focal lengths, &c.

The collimators were adjusted and the value of one turn of micrometer screw on "D" very accurately obtained by optical methods, the description of which is somewhat beyond the scope of this paper. Small electric lamps are used to illuminate the scales and render them visible when viewed by a telescope.

The tests of a transit or level begin with a general examination of the instrument and its accessories. It is then placed upon the adjustable stand between the collimators, the height being regulated to that of their horizontal axes. Collimation pivot inequality and the various tests and adjustments are made by modifications of the general field methods, the collimator scales taking the place of distant points. The laboratory methods possess the advantage of a greater precision and also are independent of weather conditions. The test of the horizontal circle is made by measuring twelve times the angle between the collimators "A" and "D". From the readings eccentricity and range of the graduations is computed. For ordinary transits it is more important to know that these do not exceed a certain amount rather than to obtain their exact value. The determination of the stadia constant is perhaps one of the most interesting operations to surveyors. The instrument is directed on collimator "D," set to solar focus, and the eyepiece being removed, a lamp is set up to illuminate the hairs so that on looking through the eyepiece of the collimator the threads are seen much enlarged. Their angular distance can be measured with great precision by means of the micrometer screw previously mentioned, and the stadia constant determined from simple trigonometrical relations.

Among the spare parts supplied with the transit is usually an extra diaphragm. Owing to the inconvenience in fitting this in the telescope, and thereby upsetting the adjustment, the constant for this diaphragm is computed from the proportion of the linear intervals of the two diaphragms. A micrometer microscope reading to .0002 $_{\mathrm{mm}}$ is used which determines these distances with great precision.

For the level value the arrangement described above for direct determination of the stadia constant is used; the telescope is slightly tilted up and down and level readings taken, the angular interval also being measured by the micrometer screw. As an alternative method the whole instrument may be set upon the level trier.

A test on the objective completes the work on the 4½″ and 5″ instrument, and in the results yielded is by no means the least interesting of the work carried on in the laboratory. The nature of the work of the Dominion Land Surveyor requires frequent astronomical observations. For seeing stars of the fifth and sixth magnitude at night, and brighter stars in the day time, great perfection is required in the telescope if its size is not to be increased beyond what is practical with a portable surveying instrument. The visibility of a star depends upon all the light rays which enter the objective being brought to a point in the focal plane; if the light is spread out the star becomes invisible.

The equipment for this portion of the test consists of a testing chart, having various sized type and geometrical figures, and an artificial star consisting of a small electric lamp behind a stop of very small aperture. Means are provided for giving a constant illumination to the chart, and a study of the figures and type when viewed through the telescope gives a general idea of its optical qualities, The most sensitive and at the same time most important portion of the test is that in which the artificial star is used. The telescope, which is set up at the opposite end of the corridor to the star and chart, is focussed on the star and the eyepiece being removed, a microscope of high power is used instead of it. The image of the star when viewed through a good objective, becomes a beautiful set of diffraction rings, varying in number according to how far the microscope is thrown in or out of focus. A study of the ring system gives an accurate indication of the quality of the objective. While at first sight it may not appear that the form of the ring system seen when out of focus is an indication of the quality of the work which an objective will give in the field, yet actually it forms a very delicate test as the nature of the defects is much more apparent when out of focus. An objective may give poor definition and yet by other methods it is hard to detect the exact cause of the trouble unless it exists to a very marked degree. The set of drawings show the influence of the various defects upon the ring sytem.

All the watches purchased by the Department and afterwards sold to surveyors for use on D. L. S. work, are submitted to a test in the laboratory before being accepted. The test is of 44 days' duration, being divided into eight periods of five days each with four intermediate days. During the test the watches are in turn placed in the three temperature boxes,—closely regulated to give temperatures of 40°, 65° and 90° respectively. The high temperature box is heated electrically, while the intermediate one is of the hot water type. It was found impossible to purchase a box of standard make to run at 40°, and the one in use is of our own design, and was constructed locally. This box has a large ice reservoir, and is regulated very similarly to the Hearson system. A capsule filled with a very volatile liquid, inside the chamber expands or contracts with small changes of temperature causing the feed pipe to deflect a stream of water either to the hot water tank or ice box, and then to the jacket surrounding the chamber. Some difficulty was experienced in securing a liquid having a sufficiently large vapour pressure at so low a temperature. This box has proved itself to be quite satisfactory, the variation in temperature in the chamber being less than ½° F. The watches are read daily and compared with the clock, from which their daily rate and variation of rate is taken. The mean daily rate and mean variation from the mean is found for change of position and temperature. If these exceed certain values the watch is rejected. Marks are given to those which pass the test according to how near they approach the standard set. The standard is high and at first only some 15 p. c. of the watches submitted passed, but probably owing to the fact that the makers realize that a greater nicety of adjustment is necessary, the percentage is very much higher now, amounting to 57 p. c. in the last year. Watches compared at the beginning and end of long periods may apparently show excellent results, but fall down under the above test, owing to the fact that the daily fluctuation may be high and yet possibly be neutralized when applied over any long space of time. The rate of the clock is determined by weekly time observations and checked daily with the three chronometers.

Previously the index correction for aneroids has been found by direct comparison with a standard mercurial barometer. Apparatus is now being installed, however, to give means of taking readings over a much greater range of pressures. This consists of an air pump of the jet type, worked from the domestic water supply and connected up to a larger reservoir which is in communication with the vacuum chamber. By this means a very close regulation of pressure is assured, and owing to the large volume of the receiver, the pressure will remain constant over a long space of time. A mercury barometer connected to the vacuum chamber indicates the pressure.

A short note on our Cooke astronomical transit may be of interest. In both the laboratories, the apparatus is being constantly improved on and added to, most of the additions being of our own design and constructed locally under our supervision. The transit, which has a 3″ objective of 36″ focal length, is a fine instrument, and is fitted with a transit micrometer. This micro-

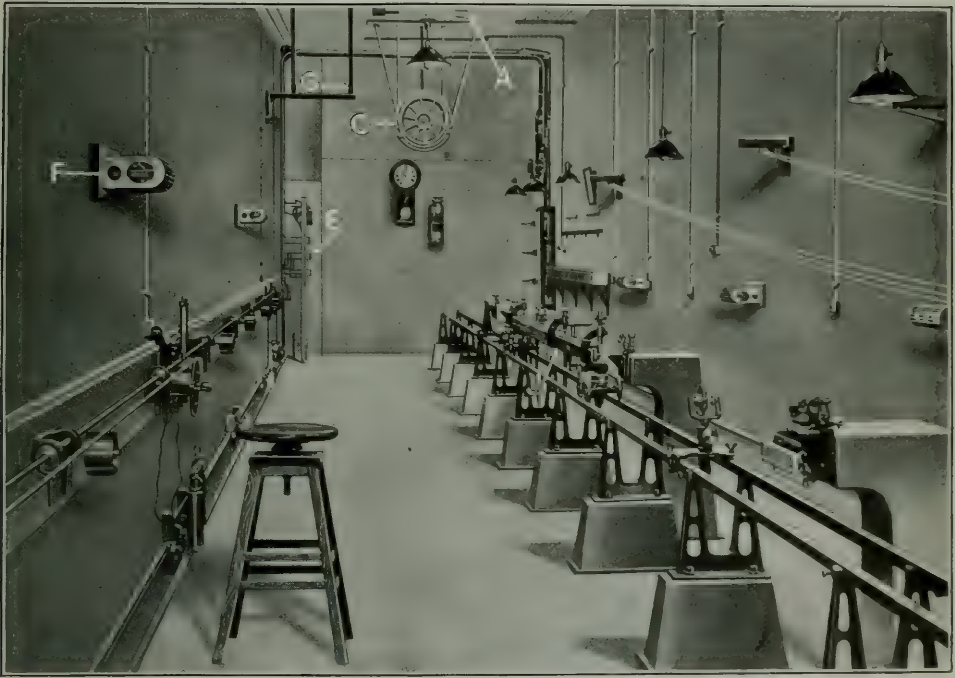


FIG. 3.

SECONDARY APPARATUS ON WALL TO LEFT.

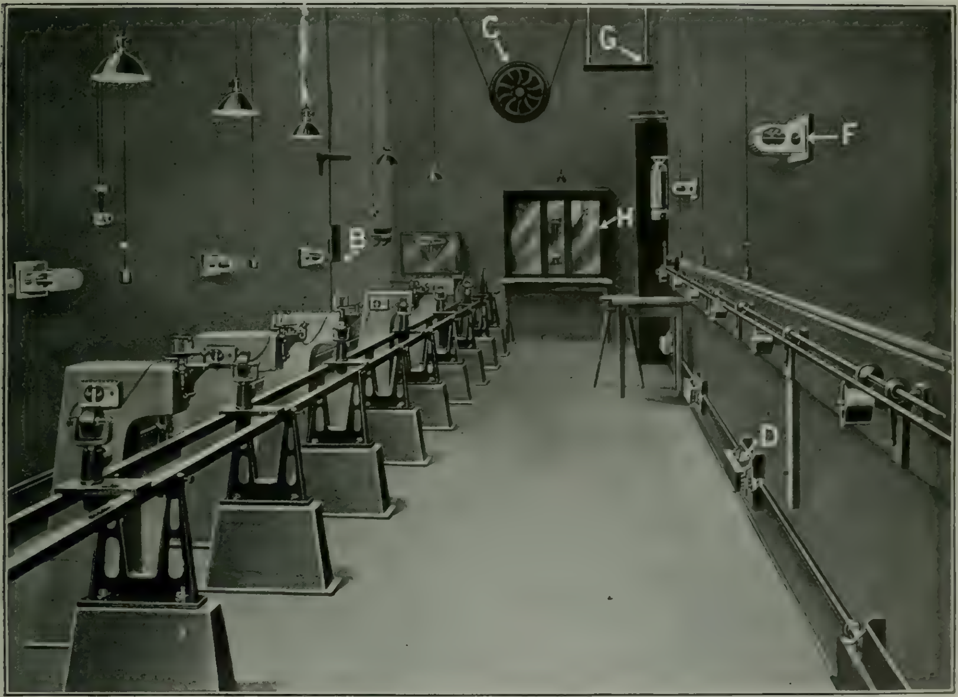


FIG. 4.

meter, however, did not give complete satisfaction. In the original form the instrument recorded contacts for the whole distance through which the movable wire was moved. A cut out device was therefore installed so that the contacts should be only given while the hair traversed the central portion of the field, and moreover a new drum having the contacts spaced at unequal intervals was fitted so that individual contact records could be identified—the arrangement is such that the records are symmetrical about the mid position of the thread. Considerable scheming was needed to fit the additions to the existing arrangement. The photograph Fig. 2, shows the apparatus in its improved form. I may state that it has given complete satisfaction.

The second and newer portion of our laboratory is on Mackay St., New Edinburgh, being a building of special design used exclusively for the testing of measures of length. It consists of two rooms, one a small room used as office and vestibule, and the other used for the testing. This latter room (shown in Figs. 3 and 4—being views looking towards the ends) is 150 ft. long by 10 ft. 6 in. wide, with 12 ft. ceiling. It is very important that the temperature for testing should be uniform, and as nearly as possible independent of the external atmospheric conditions. For this reason the walls are 4′ thick and composed of various substances to render them as non-conducting as possible. Between the ceiling and the roof is a layer of shavings 4′ thick and with two feet of shavings under the floor, and under this five′ of cinders down to solid rock. The only openings besides the door are two air intakes, one at each end of the room, and four ventilators in the ceiling. The air intakes, which are at the base of the wall, are arranged so that the quantity of air can be regulated or completely shut off. Supported from the ceiling at each end of of the room is a blower fan (c), used to circulate the air and insure uniform temperature. The exit to the outer room is by double doors with four ft. of air space between. In order to have control over the temperature of the room, an electric heating system has been installed. A large number of small radiators (D) are placed along the walls near the floor, each giving low, medium or high heat. In addition there are two heaters in each air intake. The heaters may be closely controlled from a Vermont Marble switchboard, situated at one end of the room. Ranged down the room are a series of piers, carried down to solid rock where all are joined in one solid concrete foundation. Each carries a small polished plate bearing fine graduations, the whole forming a series of permanent benchmarks. The piers are arranged at 4^{m} intervals, up to 32^{m}, with extra ones at 50′, 66′, 100′ and 30^{m}.

The distance between benchmarks is measured by a 4 invar bar carefully tested as to length and co-efficient of expansion at the International Bureau of Weights and Measures, Paris The composition of the bar is 36 p. c. nickel and 64 p. c. steel, the co-efficient of expansion being about one-tenth that of steel. The bar (see J, Fig. 3), is supported on a carriage which rolls along a set of rails laid just in front of the piers. Adjustments are provided, for bringing the bar close to the benchmarks, while making a test. The actual comparison is made by microscopes mounted on the carriage and reading direct to .001 ^{m}, the amount measured by these being as small as possible to reduce the chance of error. The bar is protected by a light metal casing, having notches to allow the benchmarks being brought very close to it. The temperature of the bar is determined by two delicate thermometers on it, graduated to tenths of a degree C. and estimated to hundredths. By measuring the distance between pairs of bench marks in turn the length of the whole base is determined,

The Laboratory Standard tapes are periodically compared with the benchmarks, other tapes being so tested only for special reasons. The tapes are suspended in front of the piers, one end being fixed to a wire which passes over a grooved pulley, and to which the weight imparting the tension is fastened, and the other is supported by a stand having a fine adjustment in all three directions. The tape may hang in a single catenary (the rail supports being of U form to allow of this) or may be supported at intervals by pulleys running on ball bearings, attached to stands which are in turn supported by the rails. Comparisons are made by microscopes reading direct to .01^{m}. The exact temperature of the room is very important in this test. It is determined from twelve delicate thermometers similar to those on the bar, arranged in protecting cages (F) round the wall, the temperature of the room being taken as the mean reduced reading of the twelve thermometers. An error of $\frac{1}{10}$ of a degree C. would cause an error of .0001 in the computed length of a 100 ft. steel tape. Before making a test the tapes are always allowed to hang freely in the room for at least 24 hours, in order that there may be no variation in temperature. As far as known the only similar piece of apparatus to that described, which was constructed by the Society Genevoise, Geneva, Switzerland, is one in the possession of the Serbian Government.

It will be seen from the above description that in making a test great precaution has to be taken with regard to temperature. Dr. Deville therefore decided to construct a secondary apparatus which would allow of tests being carried out more quickly, and yet arranged that an accuracy would be obtained beyond that needed for all practical purposes. The apparatus was entirely designed in the office and constructed locally, and has proved efficient and accurate beyond our best hopes. The surveyors' tapes are here compared with the laboratory standards which again are periodically referred to the benchmarks and also intercompared with one another. The apparatus is arranged along the west wall of the room and will accommodate at one setting tapes up to 100′ in length. consists of a series of delicate pulleys supported on ball bearings and arranged in pairs so that the tapes may be quite independent. Microscopes are provided to make the comparison. The only possible sources of error in determinations would be, (1) Variation of temperature. (2) Differential sag of tapes and standard. (3) Friction in pulleys altering the applied tension. Any small variation in temperature effects both tapes to the same degree and may therefore be neglected. The effect of differential sag due to small differences in weight of the tapes is eliminated by spacing the pulleys at such intervals that no correction need be applied. With regard to the third point experiment showed the combined friction in the whole apparatus of one serious of pulleys only amounted to .014 lbs. This does not alter the test by a greater amount than 1 in 10,000,000 and is inappreciable. Indeed, so delicate is the apparatus that it was necessary that the tension weights be applied at one end only. As in use at present, one end of the laboratory standard is attached to a fixed point and that of the tape to a screw giving longitude adjustment. A shaft supported on ball bearings runs the whole length of the apparatus and is connected to the screw through two gear wheels, so that the relative displacement of the tapes can be altered from any point along them. In making a test, the two zeros are usually brought exactly opposite under one microscope, and readings are taken on the tape and standard at the other end with the second microscope.

Here, as at Cliff St., the apparatus is being continually improved and added to as experience shows the need. By means of the weekly determinations of the bench marks of our base we hope to get some idea of its characteristics. So far our results seem to point to a slow shortening of the base in winter with a probable expansion in summer, but results covering a sufficient period to give us definite incications are not yet available.

The work carried on in the laboratories is very interesting, and it is to be hoped that this paper will serve to give some general idea of its nature, although of necessity most of the items have been barely touched on.

Almost continually some improvement or addition is being made, and in the design of these many interesting problems are encountered. From the few instances given some idea of this may be grasped.

We extend a cordial invitation to any members of the Society who may be interested in the work, to visit the laboratories and we will be pleased to demonstrate or explain any point on which they would like further information.

A MEMBER: Is there any probability of the factor intervals on a glass diaphragm being changed from time to time?

MR. WAY: I do not know of any reason why the intervals should change, the variations of temperature would be very small. In any determinations we have made from time to time we have not so far noticed any difference in any comparisons. There might be a slight difference due to the fact that in each case the intervals are determined by comparison with a spider thread. The intervals in a spider thread diaphragm will vary from time to time, due principally to the moisture in the air. That is the reason that seems to apply in most cases.

MAJOR HUBBELL: You spoke of the temperature of watches. What was the extreme temperature you tested?

MR. WAY: Forty degrees Fahrenheit, sixty-five degrees Fahrenheit and ninety degrees Fahrenheit. We test the watches in three pendant positions and dial up and dial down.

MR. BROWNLEE: What is the make of Siderial watches?

MR. WAY: Waltham.

MAJOR HUBBELL: Did you ever test those watches at a temperature thirty degrees below zero? We have surveyors out to-day using watches in temperature of thirty degrees below and more.

MR. WAY: A year or two ago we tested them at thirty-two degrees, the melting point of ice. The makers of the watches did not like the idea. They claimed that when you tested a watch at so low a temperature and then took it out and read it there was a chance of moisture, etc., collecting and they objected to the test at so low a temperature. In Switzerland they are tested at forty degrees and when we tested them at thirty-two degrees they raised an objection.

MR. BROWNLEE: We are working all the winter away below zero.

Major Hubbell: I do not think there is quite enough attention given to the surveyors working at fifty degrees and sixty degrees below zero. Instruments at that temperature become hard and stiff, chains contract a great deal. So if it affects an ordinary watch I am sure it would affect a siderial watch. I do not think we quite realize those things. I have been very much pleased with this paper. I had no idea we had such an apparatus for testing instruments in Ottawa, although I reside here now part of my time, and I think it is an excellent arrangement. I would like to have as many surveyors as possible visit this laboratory. I am sure that Mr. Way or Mr. Dodge would be glad to see them there and to show the apparatus. Mr. Dodge might give us a few remarks in connection with this apparatus. We have a place there about which surveyors from a distance know nothing. We do not advertise enough; we are very reticent. We were told years ago that we should not go into print, if our name appeared in the paper we would be criticised. At our last half dozen banquets the members of parliament and many others have told us to make ourselves more prominent and I think that it is up to us to do it. I move a vote of thanks to Mr. Way for his very valuable and interesting paper to this Association.

Mr. Fawcett: I suppose that engineers can take their tapes to be standardized at this place?

Mr. Way: Oh yes.

Mr. Fawcett: A fee I suppose?

Mr. Way: A small fee, I think fifty cents or something like that.

Mr. Fawcett: I suppose you test them at a certain temperature.

Mr. Way: It depends on the tension. For a one hundred foot tape the tension is ten pounds, for a two hundred foot or three hundred foot, twenty pounds. We can test at any tension you wish.

Mr. Fawcett: We were making some measurements two years ago on the international boundary and applied twenty pound tensions to steel tapes. We found by applying a thirty pound tension we got better results.

Major Hubbell: What tape would that be?

Mr. Fawcett: Steel.

Mr. Brownlee: Thirty pounds is more normal than ten pounds.

Mr. Dodge: There is one little point that Mr. Way mentioned which I might enlarge upon in connection with the forty degree temperature test. As he said, we started out with thirty-two degrees. The reason was because we wanted to get as wide a range as possible. At the observatory at Besançon, (?) which is the French observatory, they use thirty-two degrees. At the English observatory at Greenwich they use forty degrees; at Neuchatel in Switzerland they use four degrees Centigrade, which is about forty degrees. At the inception of the work, in discussing the question with Dr. Deville, we thought it advisable to use o° centigrade, and started off with that idea. That watches we get from the makers have to come up to a certain standard. We test them and if they do not come up to that standard they are rejected. At first when we had no facilities for testingwatches we wree obliged to take it for granted that they came up to the standard So you will understand that the makers have got into the habit of sending the watches along and having them accepted without question. As soon as we started testing we started throwing back seventy-five per cent. and eighty per cent. of the watches submitted. They objected right away. We pointed to the guarantee and said: you guaranteed them to come up to these specifications and they have not done so. There was a good deal of correspondence and finally they sent their head watch tester and he talked it over with us. One point he objected to was testing at thirty-two degrees. He said that their adjustments were made between forty degrees and I think a maximum temperature of eighty-five degrees, andhe objected to our test of thirty-two degrees because he said the watches were tested by an adjuster at a temperature of about forty degrees, and if they were tested at thirty-two degrees that was an unfair condition. Dr. Deville felt that we should meet them in every way we could while still keeping up our standard, and after talking it over we decided that we would try to raise the temperature. We could not do so at that time, because, as we explained, there was no temperature box of forty degrees on the market, and we had to contrive something ourselves. Since then we have been testing watches at forty degrees. Personally I do not think that had much to do with the rejection of the watches, but I think the fact that fewer watches are now rejected is more because the manufacturers find that they have to be more careful with the adjustment or they will be thrown back on their hands.

Mr. Fawcett: What is the standard temperature at which you adjust tapes?

Mr. Way: Sixty-two degrees Fahrenheit.

Mr. Steel: What is the probable effect of low temperatures on the watches? Although they are only tested in the laboratory at forty degrees there is no doubt that very often in the field there is no possibility of keeping them anywhere near the temperature. Very often they must be down to nearly zero temperature. I would ask what the effect would be.

Mr. Way: It is very hard to answer. In some cases we find that watches will gain and in other cases we find that watches that have been gaining will simply go about the same rate. It apparently depends a good deal upon the adjustment and some other factors. The watches do not always act according to any certain rule in regard to the change of temperature. We get change of rate but we cannot say whether it will always be in the one direction or the other.

Mr. Dodge: In the field can you not arrange to keep your watch from getting down to so low a temperature?

Mr. Steel: It is rather difficult at times. A person taking an observation may have to have his watch exposed quite a length of time.

Mr. Dodge: Can you not arrange to keep it in your hand?

Mr. Steel: Yes, but even then it is liable to get chilled.

Mr. Dodge: When a watch is suddenly subjected to such a low temperature you are liable to injure some of the mechanism. I think, in fact, that a very sudden change might be liable to crack some of the jewels. The ordinary individual has a very exaggerated idea of what a watch will do in the way of rate keeping. You will hear chaps say: my watch does not change a minute in a month. That may be quite true, it may not; but if he had had his watch compared every day with some clock or some reliable time-keeper he would have found that during that month the watch might have wobbled fifteen seconds one way or the other, day after day. The most severe standard for the highest class of watches would seem to some people very lax, and yet it takes the most expert adjusters to adjust a watch to such perfection to meet the standard.

Mr. Brownlee: But do you not think it is up to the ordinary surveyor to keep his watch adjusted as much as possible. Do you not think it has a tendency to make him more careful in his work?

Mr. Dodge: My own opinion is that the surveyor's best plan is to check his watch with the sun as often as he can. Of course, in the case of a subdivider considerable error in actual time is permissible; but where at all possible a base line surveyor should take an observation for time either immediately before or immediately after azimuth observations.

Mr. Brownlee: I had a Howard which I lost in the mountains, which I purchased in Boston forty years ago. They gave a certificate of a rating of three seconds a month. Mr. Ogilvie carried it in the Yukon for two years as the best he could get. Finally it was lost, an Indian got away with it.

Mr. Dodge: In testing a watch it is kept for four days in each one of some five positions, three pendant positions, dial up, and dial down. They take the mean rate for each of these positions, that is the mean daily rate. The allowable difference between the mean daily rate in what they call the pendant positions and what they call the dial positions or the flat positions is, at Neuchatel, I think, four seconds per day. That is in the very highest grade of watch, a movement that would cost here not less than $350.00 without the case.

Mr. Brownlee: Then that was a farce about the three seconds a month?

Mr. Dodge: Decidedly.

Major Hubbell: In speaking of the different positions in which watches are tested, it would be a good idea to test them sometimes in the way they are handled when they go to camp-upside down, in a vest pocket, on the table, at all kinds of tempera, tures.

The Chairman: Sometimes the surveyors cannot just exactly tell how they lay their watches down.

Motion of thanks agreed to.

The Meeting adjourned.

THURSDAY AFTERNOON SESSION.

NOTES ON PLANE TABLE WORK

By C. R. Westland.

1. In choosing points for determining elevations, choose points at any general change of grade, and in general take enough points to fix the contours closely, or to be able to closely determine them by interpolation.

2. Contours crossing streams almost always run well up the stream when near the water line, and do not cross abruptly.

3. Prominent topographical features too far distant to get rod readings on, may often be cut in by intersections from two stations, a cut from a third station being taken as a rule, as a check. The elevation of the point can be determined by reading the angle of elevation or depression from one of the stations, noting it down along the cut when taken at the first station, where it will be convenient for use when the distance to the point is found.

4. Readings should, as a rule, be taken on more than one corner of a building in order to locate it properly, as, otherwise, when the rodmen bring in their sketch of it, the orientation of it would be incorrect when plotted. Often, when a second point can not be conveniently obtained, the orientation of the building may be determined by pacing the offset to the produced side of the building, the second point being thus unnecessary.

5. In cutting in hilltops, etc., a prominent tree, boulder, or something which can be seen from the various stations should be used if possible. Otherwise a third cut will not pass through point as determined by the first two cuts. If the tree tops were sighted on for elevation, a quantity, to allow for the height of the trees will have to be deducted from the computed elevation, to obtain the approximate elevation of the hill top.

6. The buildings are sketched by a rodman on a small pad which he carries, the sides being paced and entered on the sketch in feet or metres, according to the scale being used. On this sketch he should also mark the position of the points rodded, as well as the approximate direction of the table.

7. If a station off the main traverse is desired, the rodman can choose a point from which a good view of the country to be reached can be obtained, and after rodding it, mark the point with a hub.

The instrument man can best orient the table at this new station if, when plotting the previous station, he draws two fine cuts, one at each end of the straight-edge, marking them similarly so they will be easily recognizable at the next station, where it will be used. These two cuts give an accurate long line along which to lay the straight-edge when preparing to orient the table at the new station. Several stations are often chosen from one set-up, and unless the various pairs of cuts are marked, mistakes will possibly occur in orienting the table, by using the wrong ones. This would, of course, ruin any work at this station or continued from it. It thus follows that the correct orienting of the table is of primary importance.

8. In setting up at a station, do not set the centre of the table over the point, but, with the table roughly oriented and levelled, set the point itself, as plotted, over the point on the ground. When the table is levelled and oriented the centreing can be checked by plumb-bob, and if out, can be adjusted, the relevelling and re-orienting necessary, not affecting the centreing to any extent. The table should be carefully levelled up, so that, the alidade being in adjustment, the bubble will remain in centre when the vernier reads zero, for all positions of the alidade.

9. To orient the table at any station, lay the straight-edge along the cuts, but in the reverse direction to what it was when the cuts were made, and, with the clamp on the instrument head loose, so the table can move freely, bring the cross-hair onto the picket at the station where this station was established from. The tangent screw can be used to set accurately. The table must be very firmly clamped as any error in orientation should be prevented.

10. A striding level is provided with the alidade. This can be adjusted by the end-for-end adjustment so that the bubble is parallel to the telescope to which it can be attached. For station sights or for any long sights, or for any important points the level should be used, in order to get the index error to apply to the vertical angle.

11. The collimation of the central wire, and also of the vertical wire, can be corrected by the regular method of turning the telescope about its own axis 180 degrees and bringing half way back by the small screws at the sides of the reticule. The vertical cross-hair must also be made truly vertical. This can be done by setting the upper end of the cross-hair on a point and then elevating the telescope until the point appears at the other end of the cross-hair. If the point is off the wire correct by the adjusting screws on either side, under the telescope on the shoulders which prevent the telescope from turning through more than 180 degrees.

12. The vernier should read zero when the bubble of the striding level, after adjusting, is in centre. If it does not, make it read zero by the adjusting screw on the vernier, the bubble, of course being kept in centre.

13. If the table is warped or of uneven surface in any way, the alidade will not lie firmly, but will rock slightly. If this be the case, the table should either be exchanged or planed down. Until this is done, the index error must be determined with the striding-level for all readings.

14. When inconvenient to read the whole interval, on the outside wires a half interval or a quarter interval may be read and the quantity multiplied by the correct amount, although doing so usually means some loss of accuracy. In many cases the reading of fractional intervals is unavoidable, either on account of obstructions hiding the rod for the most part, or on account of the distance. In some cases even eighth intervals are useful, though not suitable for important sights. In taking readings through trees, etc., many sights could not be taken except by using any two wires that can be made to read on the rod.

15. For computing elevations, Stadia Slide Rules are used, or when not available, the following rule is much used:—

$$\frac{\text{Angle in minutes x Distance in metres}}{1000} \text{x} \frac{19}{20} = \text{Change of Elev. in Ft.}$$

This rule is very accurate for all ordinary angles and distances, but above 10° the error begins to be noticeable, and for larger angles a correction should be applied to the result obtained.

Distance.	Angle.	Error in feet.
100″	10°	0.0
100″	15°	0.6
100″	20°	1.8

16. To obtain the proper elevation angle after reading the stadia distance, the middle wire must be set on the rod at the height of instrument, or if this can not be seen, then at some known point on the rod, the distance of which from the height of instrument can be measured, and the correction applied to the computed difference of elevation. For rough contour points, the top of the rod can often be taken as being 5 feet above the height of instrument.

17. Heat and moisture will change seriously the scale of the paper so should be avoided. In damp or misty weather, or when the dew is falling, the paper will expand, while, in the sun it will

contract. An umbrella and holder is provided as a protection against the sun. If celuloid sheets be used instead of paper, the weather will not affect them, and work can be carried on, mists and slight drizzles having no effect. The sheets will require to be shaded from the sun, however, as when paper is used, as the reflection from the table is very hard on the eyes, and also the sighting is very difficult when facing the sun, unless the telescope is shaded. Celluloid sheets though not so large as the paper, are particularly convenient for lake work, etc., as getting wet does not injure them.

18. The far shore of a river or pond or small lake can often be plotted from points obtained in an indirect manner. The station must be well above the water in elevation and this elevation known. Points on the far shore can be chosen, as many as required, and the angle of depression to the height of instrument at them, very carefully read and corrected for index error by bubble. Now, the change of elevation being known and the angle of depression being known, the distance can be computed and the point plotted as usual.

19. When running, roughly speaking, in one direction for a long distance the orientation can sometimes be kept correct by choosing, at one of the first stations, a well defined point on the horizon, as nearly in line with the general direction of the traverse as possible, and making a long cut on it. The orientation can be checked at any station by setting the straight-edge very carefully along this cut, and then if the cross-hair does not pass through the distant point cut on, make it do so by moving the table with the tangent screw.

20. All lines should be drawn finely and carefully, close to the edge of the rule of the alidade. With the alidade and table in proper condition, the contact of the rule with the paper will be continuous throughout its entire length, and in drawing a line along the edge care must be taken to keep the pencil at the same inclination, otherwise, the pencil point will deviate from a straight line. The same error will occur if the pencil point is not kept finely sharpened. This will also be the case if the straightedge should be raised above the paper at any point, unless great care is taken that the point of the pencil does not run under the rule. For cuts, etc., the pencil should be very hard, a chisel edge being often used. For detail work, such as sketching contours, etc., a somewhat softer pencil will be found better, though it will require more attention to keep it sufficiently sharp. A very convenient and useful pencil sharpener is made by pasting a small strip of fine sand paper on a piece of wood of the same size. The pencil points can be readily touched up at any time by rubbing along this strip.

21. Often the triangulation is being carried on at the same time as the topography, or, if completed, has not been computed and so cannot be plotted. In this case, not only can the work be controlled by tying onto the stations, or occupying them when possible, but cuts can be taken from plane table stations well distributed over the work. Three cuts per station are necessary, and four much preferred. When the triangulation is plotted these stations can be correctly plotted, graphically or as regular three point problems. Thus the topography can be regularly adjusted to these stations, the stations as plotted in the field being superimposed on the correctly plotted ones, any small discrepancies being distributed proportionly.

22. In determining the elevation of a new station, it will be found that it will be much more accurate to not only compute the difference of elevation from the angle read at the old station, but to also take a reverse reading for angle and recompute the difference of elevation and take the mean of the two determinations as the true difference. On hot days or other days when the refraction is bad, the difference between the two determinations will often be very large, but by using the means carefully, very little error will result, especially if the two determinations have been made within a short time of each other when the atmospheric conditions were the same. A traverse run in this manner for a great many stations will close very closely on a B. M. at the end of the traverse. The lengths of the courses will also be more accurate if read in both a direct and reverse direction and the mean taken.

23. In small lake and river work long sights can be read across the water if the conditions are right, especially if the sun is on the instrument man's back, when it will then make the rod very easily read on. The work can often be arranged so that a number of stations shall always be available for occupation, those where the sights will be away from the sun in the morning being used then and the others will then be suitable for the afternoon.

24. On lake or river work stations can sometimes be best carried on by forming quadrilaterals with them, two being used as a base, to cut in two others from, these two thus cut in, being used in turn as a base from which to establish two other points to form a new quadrilateral. By using this method of intersections, the errors due to using poorly determined distances, and which often accumulate to a considerable quantity, will be eliminated. Occasionally a distance between two points, obtained by intersections from two other stations can be checked by stadia, and then corrected for any error.

25. If the stadia wires are rules on glass, they sometimes give a great deal of trouble on account of their indistinctness, as the fine material filling the lines comes out. By using great care this may be remedied by applying very lightly, with a piece of soft material such as chamois, etc., a little of the carbon deposited on a saucer, when a candle is burned underneath it. The glass reticule, if wiped gently in a direction at right angles to the lines will retain in the lines enough of the carbon to make the lines very distinct for stadia purposes. If the lines appear to be too heavy, the reticule can be again gently wiped, until the desired finess of line is obtained.

26. A Correction for Curvature of the earth, when computing elevations from very long sights, will be necessary. This correction is always +ve. That is, a point is always higher above sea-level than it would be computed to be, using distance and vertical angle only. Thus, if an angle of depression be read, the proper correction will be, co - mputed amount + correction for curvature. And if an angle of elevation has been read, the correction will be, + computed amount + correction for curvature.

The following rule is usually used for curvature:—

$$\text{Correction for Curvature} = 8'' \text{ x } (\text{No. of Miles})_2$$

For distances up to ten miles, when curvature would have to be allowed for, no correction for refraction is, as a rule, made. If applied it is always - ve, thus making the curvature correction smaller by a small amount. For distance under ten miles, the refraction correction is so small compared to the error that may be made in reading the vertical angle, as the alidade only reads to minutes, it is usually omitted.

If 7″ be used in the rule in place of 8″, the correction will be very nearly right for both curvature and refraction.

EXAMPLE 1.

Elevation of station occupied is 100 feet.

Angle of elevation read to hilltop 6 miles away is 2 min.

Apparent correction to get hilltop elevation.. = + 18.3 ft.
Curvature correction 8″ x 6_2.............. = + 24.0 ft.
Refrac. corr. (- negligible small quantity) ... ————————
True correction to apply to get hilltop...... = + 42.3 ft.
∴ Elevation to hilltop...................... = 142.3 ft.

Example 2.

Elevation of station occupied is 100 ft.

Angle of depression to a point 6 miles away is 6 minutes.

Apparent correction to get elevation of point. = − 55.3 ft.
Correction for curvature.................. = + 24.0

True correction to get elevation of point..... = − 31.3
∴ True elevation of point................. = 68.7 ft.

Example 3.

Elevation of hilltop 6 miles away is 100 ft.

Angle of elevation to hilltop is 2 minutes.

Appar. am't hill is higher than station occupied = + 18.4
Curvature correction...................... = + 24.0

True am't hill is higher than station occupied = + 42.4

But elevation of hill top is 100 ft.

∴ Elevation of station occupied............ = 57.6 ft.

Example 4.

Elevation of point 6 miles away is 100 ft.

Angle of depression to point is 6 minutes.

Appar. am't point is lower than station occupied = 55.3
Curvature correction...................... = + 24.0

True am't point is lower than station occupied = 31.3

But elevation of distant point is 100 ft.
∴ Elevation of station cocupied............ = 131.3 ft.

27. In the case of very long sights for head-lines, the distance can often be much more accurately determined by breaking the line up into two or, if necessary, three parts, and reading each part separately. The whole distance can be read as a check, when the rodman is rodding the station. The rodman can then come in towards the table along the line of sight until he is close enough to the table for the distance to be read accurately. This is then done, the rodman marking the spot temporarily. The remainder of the distance, if the line has been divided into two sections, can then be determined, either by setting up temporarily at the intermediate marked point when going to the new station and sending the rodman ahead to the station, or by occupying the new station. and then

sending the rodman back to the intermediate point, when the remainder of the distance can be accurately read, the sum of the two sections thus determined giving the plotting distance of the station from the last station. The error caused by setting up the table at the new station without having the station accurately determined can be neglected as a rule, as the true position of the point will be only a very small distance from the point as plotted from the check distance read at first. When more than two sections of a line are used, each section can be read from temporary set-ups at the intermediate points, the sum of them being plotted along the cut made at the first station. The angle for computing the elevation of the new station should also have been read at the time the cut was made at the first station.

28. The Plane Table Three point Problem.

By means of this three point method a station may be established at any desired point, where a good view of the surrounding country can be obtained, and if the position of the point chosen is not known on the sheet, it can now be found by means of the resection of lines from three fixed points whose positions on the sheet have already been plotted. The great advantages of the plane table for mapping purposes are due to the rapidity with which it obtains results by the use of the graphic method of triangulation, and also by the facility with which the topographer may determine his position in the field, by means of graphically solving the three point problem. The Three Point method is only applicable when the country is fairly open and the signals and points whose positions are plotted on the sheet may easily be seen. Under these circumstances, it is manifestly much superior to ordinary methods, as the topographer is quite free to choose his station without any reference to a previous station. No backsight has limited his choice of position or the necessity for a satisfactory foresight. To secure this commanding view he need not preliminarily set up his table at a point of little value as regards detail, or traverse to the position by lines cut through obstacles of all kinds, such as woods, etc.

The number and position of plane table stations are governed by the extent of the work and by the amount of information desired to be shown on the map. Thus, when the three point method can be employed a great saving naturally results, in stations occupied, as otherwise many comparatively useless set-ups will probably be found necessary in order to carry the line forward. And as considerable time is used up for each set-up made, the saving totals to a considerable amount.

When the point selected on the sheet as representing the actual point occupied is not correctly chosen, the table thus not being truly oriented, the lines drawn from the three projected points, when sighting on the corresponding actual points, will not intersect at one point—the point incorrectly chosen to represent the point occupied, unless this point lies along the circumference of the circle passing through the three fixed points on the ground, known as the Great Circle, the triangle formed by the three fixed points on the ground being known as the Great Triangle. Except for this case, which gives an Indeterminate position for the point sought, and which can usually be avoided in choosing the three fixed points to be used, the three resection lines will either form a triangle, known as the Triangle of Error, or, if not forming a triangle, two of the lines will be parallel, intersected by the third.

To obtain the three resection lines, the edge of the alidade is carefully laid along a line drawn to cut the point chosen to represent the point occupied and one of the plotted fixed points, the eyepiece end of the telescope at the same end of the line as the point chosen to represent the point occupied. The table is now turned until the actual point represented by the fixed point cut by the alidade comes onto the vertical cross 2ire of the telescope. The table is now clamped in this position, and, with the edge of the alidade cutting through the plotted position of the second fixed point, the telescope is pointed so that the actual second point is on the wire. A line is now drawn to cut the first line. Now with the edge of the alidade passing through the plotted position of the third fixed point, and the actual third point on the wire draw a third line. This line will either cut the other two lines or be parallel to one line and cut the remaining one. Of course, if the three lines intersect at one point, no further work is necessary, as the point of intersection is the point sought, and the table will be properly oriented in its present position. However, as the three lines rarely will intersect in one point, there is usually the Triangle of Error, or, when the point chosen on the sheet is in range with two of the fixed points, the two lines cut by the third.

Before proceeding with the solution of the Three Point Problem, a statement of the importance of the relative position of the three fixed points with reference to the new station being determined, will be of value, since their position governs the strength of the determination made, though, of course, it is not always possible to pick and choose the stations, on account of the limited number available for use.

(a) When the new station is outside the Great Circle, the strength of the position determined will be weak when the new station is some distance from the circle, as the angles will be small.

The determination increases in strength for given angles as the middle point approaches the new station.

When one angle is small or zero, (when the points are in range) the determination will be strong, provided the two points making the small angle or in range are not too near each other compared to the distances to the new station or to the third station; also provided that the angle to the third point is not too small.

(b) When the new station is within the Great Circle, the strength of the determination increases as it approaches the centre of gravity of the Great Triangle (formed by the three fixed points).

(c) When the new station lies on or near the Great Circle, its position is indeterminate, since it is obvious that all points on the circle will have the same angles subtended by the fixed points.

The method of solution known as Lehmann's Method is the simplest and most direct, and is always applicable. There are a number of other graphic solutions, some of them often unsuited for field application. The directions for Lehmann's Method are best expressed in the form of rules, or conditions.

The point sought is understood to mean the true position on the sheet of the station occupied.

The topographer is assumed to be facing the signals in the field and the directions right and left are given accordingly.

RULE 1.

When the Triangle of Error is inside the Great Triangle, formed by three fixed points, then the point sought must be within the Triangle of Error.

RULE 2.

When the Triangle of Error is outside the Great Triangle, then the point sought will be outside the Triangle of Error. In this case, the position of the point must be such that it is to the right of all the lines drawn from the station occupied in the direction of the three fixed points, or to the left of all these lines. Of the six sectors formed by the three lines, it can be seen that only two will fulfill this condition.

RULE 3.

The exact position for the point sought is now determined by the condition that the distances of the point from the lines drawn must be proportional to distances that the actual respective fixed points are from the station occupied.

General Rule giving in condensed form the above three conditions.

The point sought is always distant from each of the three lines drawn from the three fixed points in proportion to the distances of the actual corresponding points from the station occupied, and it will always be found on the corresponding side of each of the lines drawn from the fixed points. When the point sought has been estimated and plotted from the foregoing rules, a new orientation should be made, and if the lines now drawn from the three stations intersect at that point, it proves the estimate to have been correct, and the table is now properly oriented for work. If a new Triangle of Error is formed it indicates that an erroneous estimate has been made, and the operation must be repeated. The smaller the Triangle of Error, the closer the estimated position of the new station is to the true position sought.

If there has been any distortion of the sheet, due to exposure to atmospheric conditions, since the fixed points have been plotted on it, the Triangle of Error obviously cannot be wholly eliminated, as the relative position of the plotted points will not remain the same as the position of the points on the ground.

C. R. WESTLAND, D.L.S.

NOTE:—The foregoing remarks, as a rule, refer to the general practice of Plane Table Work, but the instrumental remarks refer in some cases more praticularly to the Keuffel and Esser alidades.

C. R. W.

January 2nd, 1915.
File 106.

C. F. Aylsworth, Esq., D.L.S.,
President, D.L.S. Association,
Madoc, Ont.

Dear Sir:

Replying to your request of the 15th ult. that I should write a paper on "The Survey of the Red River Lots" for the Association's next annual meeting, I may say:

The proposition of writing such a paper for the D.L.S. Association has frequently occured to me since you introduced the subject a year or so ago, and I had become fully convinced that such a paper might be of interest to the Association, and would have taken great pleasure in supplying such data as I have in my possession.

Last year, however, I noticed that Mr. Pearce, of Calgary, wrote a very full and comprehensive paper entitled, "Early surveys and Administration of Lands in Manitoba," which seems to embrace practically all the principal features of interest in the matter of the settlement surveys.

I feel that anything in the way of a paper on this subject would, after Mr. Pearce's exhaustive article, appear quite superfluous, at least until after the lapse of a few years.

I am, however, in keeping with the spirit of your letter, enclosing copies of my letters of instructions regarding the surveys of the "Outer Two Miles" of several of the Parishes; which, I trust, may be of interest to you.

In Prof. John Macoun's "History of Manitoba and the Great North West" at page 442, the following passage occurs:

"A survey of the 'River Lots' had been made in 1822 by a Mr. Kemp, and at this time all lots were reduced to eight chains frontage and extended back one hundred and sixty chains to the rear, each lot containing one hundred and twenty-eight acres."

Pearce in his article says:

"The Hudson's Bay Company's survey of river lots on the Red and Assiniboine rivers was made by their Surveyor, Taylor, in 1836-7-8. This was what was generally called the 'Old Settlement Belt Survey.' "

I regret I will be unable to attend the meeting of the Association; but take this opportunity of wishing you the compliments of the season, and hope that you may have a very satisfactory meeting. I remain,

Sincerely yours,
J. W. HARRIS.

SURVEYS OFFICE, DOMINION LANDS,
WINNIPEG, MAN., 12th JUNE, 1874.

Sir,

I am directed by the Surveyor General to cause a survey to be made of the "Outer two miles" of the Settlement Belt on the Red and Assiniboine Rivers.

You are hereby instructed to perform a part of this service, viz., to survey that portion of the "Outer two miles" belonging to the Parishes of St. Charles, St. John, and St. James. You will first proceed to lay out in the field the zigzag rear line of the "Outer two miles" running the necessary section and subdivision lines as shown on the accompanying tracings, as it will be advisable before proceeding with your calculations of the lot widths to ascertain whether there are any and what differences between your own and the former chaining of these lines. You will then post the rear line, leaving a road allowance of one chain in width along it, except where a regular section road forms the rear boundary. The posts will be planted on the inner side of the road (i. e. next the Settlement). they will be at least three inches square and be marked with the numbers of the lots, which will be the same as those of the River lots; and on the side next to the road with the letter "R."

There will also be road allowances of one chain in width through the "Outer two miles", and where the lots are narrow the road will be taken off of two adjoining lots, one half the width from each lot, in which case posts will be planted both in front and rear on each side of the road and marked to show their position, but where a wide lot is next to a very narrow one the whole of the road will be taken off the wide lot.

These road allowances will be laid out on Parish boundaries, and there will be intermediate ones at intervals of about two miles. These road allowances will have to be run through and chained, to serve as a check on the depths of lots, and if a serious discrepancy should be found between any distances so chained and that measured by scale on the tracing, you will report the same before proceeding further with the posting of the rear line. You will please inform parties who may be dissatisfied on account of such road allowances being taken out of their land that it is considered necessary, and that they will be compensated in scrip at one dollar and fifty cents per acre for the lands so taken.

You are also authorized to state to parties who have claims within the "Outer two miles," (and if such claims are considered good by the Department) that if they are willing to take land scrip at the rate of one dollar and fifty cents per acre for their claims so that the lines may run through without break, that the same will be allowed.

All claims within the "Outer two miles" are to be carefully surveyed in order that the extent and position of the same may be correctly shewn on the plan, and where the above arrangement cannot be effected, further instructions will be given to you as to the manner in which such claims are to be posted, and how roads are to be provided for the same where necessary.

Your pay will be at the rate of five ($5.00) dollars per day, and all reasonable expenses.

Your party will be limited to six persons, an allowance of sixty cents per day for rations will be made for yourself and each man of your party.

A diary is to be kept shewing each days proceedings and sent in with the other returns at the close of the survey. You are also required to forward fortnightly reports and diagrams shewing the progress of your field work.

Your accounts for this service are to be in triplicate and will be made out on printed forms furnished by the office.

I have the honor to be, Sir,
Your obedient servant,

(Sgd.) A. H. WHITCHER.
INSPECTOR OF SURVEYS.

J. W. HARRIS, ESQ., D.L.S.,
Winnipeg, Man.

DOMINION LANDS, SURVEYS OFFICE,
WINNIPEG, MAN., 27TH MAY, 1876.

MEMORANDUM OF FURTHER INSTRUCTIONS FOR THE SURVEY OF A PORTION OF THE "OUTER TWO MILES."

In addition to the completion of the work referred to in former instructions, the laying out and posting of the "Park" claims will be proceeded with as shewn on the tracings accompanying this memorandum.

All road allowances in the "Outer two miles," except where otherwise shewn on the tracings, will be fifty links wide.

The corner posts of the rectangular lots which are to be laid out, will be planted on the side lines of the two mile lots, and the lots will be designated by letters of the Alphabet, beginning with capitals, on exhausting which, commence afresh, thus, Aa, Bb, Cc, and so on, adding a small letter respectively at each repetition of the Alphabet.

Attention is called to the necessity of giving the exact metes and bounds as surveyed on the ground, of several lots, as also the distance from the front or rear, on one of the lot lines.

In order to comply with the provisions of an Act passed during the last session of Parliament respecting Roads and Road Allowances, it will be necessary to increase the width of the road allowance along the front line of the outer lots to one chain and fifty links, to effect which only the posts at the intersections, which occur at intervals of about two miles, would require to be moved. Wherever road allowances occur along the rear or "zigzag" line, the posts will have to be moved inwards, so as to give them a width of one chain and fifty links, leaving the legal subdivisions intact, or in other words, not disturbing the outer limit of the road allowance, as it now exists. The road allowances running through the "Outer two miles" from front to rear, will remain as they now are, viz., one chain wide.

All persons having "Parks" or other claims in the "Outer two miles" are to be notified that applications for Patents for such lands may now be made to the Hon. the Minister of the Interior. A memo. shewing the nature of the evidence which applicants will have to furnish in support of their claims, is herewith enclosed.

On the completion of the survey a plan will be prepared on a scale of 20 chains to an inch, on which will be shewn the dimensions, and areas of all the lots, and the names of the owners of the "Park" lots, and in addition to the field notes and diary of the survey, a report will be required shewing the extent and value of the improvements, length of occupancy, and whether disputed as to title, &c.

The pay for this service will be at the rate of five dollars a day, with all reasonable expenses; a party not exceeding seven persons will be allowed, and the rates of pay will be $1.50 per day for 1st chainbearer, $1.25 for 2nd do. $1.25 for a cook, the others not to exceed $1.00 per day each; together with the usual allowance of sixty cents per day for rations, for yourself and each man of your party.

Accounts and vouchers are to be as usual rendered in triplicate, and on the printed forms herewith enclosed.

By order of the Surveyor-General.

(Sgd.) A. H. WHITCHER.
INSPECTOR OF SURVEYS.

J. W. HARRIS, ESQ., D.L.S.,
Winnipeg, Man.

UNFINISHED BUSINESS.

MAJOR HUBBELL: The election of Vice-President in each of the provinces has always been more or less a bone of contention with the Dominion Land Surveyors. In the old days we had no Vice-Presidents for the different provinces, but as the surveyors obtained work out in these provinces, and organized societies there, we have had to recognize the fact that they should have a voice in the working of our Association. A few years ago I proposed that a Vice-President should be elected from each province. The method of electing them, of course, was open to debate. It was suggested at the time that several of the most competent surveyors for each province be named by the committee and forwarded to the different members of the province for them to select their representative. This has been done, and has worked fairly satisfactorily, but Mr. Wallace has taken exception to this method, although offering no solution except saying that we do not know the men. I would like to have your views as to the method that should be pursued. We, in Ottawa, are doing all we can to help the Western members and the Western members must not think we are trying to run the Association, because we are only too glad to give them every opportunity to express their opinions and ideas as to the way the officers of the Association should be elected, or on any other subject.

MR. AKINS: How would it do to have each Provincial Association send to the members in their province, asking them to vote on the proposed member and then each Provincial Association elect its own Vice-President.

MAJOR HUBBELL: If you only realized the apathy that is shown in regard to the selection of these Vice-Presidents in the Northwest, you would throw the whole thing over. Of the 236 ballots I sent out to members in the West, about 50% were returned.

MR. DODGE: If a couple of blank lines were left after the names would that get over the difficulty?

MAJOR HUBBELL: I do that, and suggested that they should add any name they wanted to. I do not think the Provincial Organizations would take enough interest to do that.

It was moved by Mr. Seymour that the method of election of second Vice-Presidents be not changed.

Motion agreed to.

THE CHAIRMAN: A very important question has been debated since we came from the West, about a new and indestructible post for marking corners. We have five samples for inspection and the judgment of members. The question is open for discussion.

Dr. Deville, Surveyor General: Mr. Chairman, I did not intend that this matter should come officially before the Association, but I had procured those specimens of United States posts and thought it would be of interest to members of the Association to see them, so I sent them over here for you to look at. If you feel disposed to discuss the matter I would be very glad for my part to get suggestions. This is a post that I got for marking townsites. We have been using it now on four different occasions. It has been used for the townsites of Woodhaven, Banff, Churchill and also at Jasper. I have only seen one of these places, that is Banff, and I must say I was very much pleased with it. The post was put in all kinds of places, for instance in concrete sidewalks on the main street of Banff. They just made a whole in the concrete, put the post in flush with the surface, put a little more concrete on top, and it made a neat mark on the surface of the concrete. There was no chance to pull it up. I sent a circular to all surveyors in active practice asking their views about new posts, more permanent than the one we are using for township surveys. I got a number of replies, but it is not possible to come to any definite conclusion from the proposals that have been made. Here is an interesting letter from Mr. Melhuish, D.L.S., who has been using the townsite post at Woodhaven. He says:

The iron posts which were used for marking lot corners at Woodhaven had the following dimensions.

Twenty-four inches long; seven-eights inches outside diameter; diameter of plug at each end, one and one-half inches; weight of post, approximately two pounds four ounces.

To plant these posts two bars were used, made of galvanized iron pipe, five and one-half feet long, one and one-half″ outside diameter. One end of the bar was pointed, the other end fitted with a cap two inches in diameter to be used as a tamp. A hole twenty-four inches deep was punched in the ground and the post planted, the bar then being reversed and used as a tamp. By this method, most rocks, except bed rock, which are in the way, can be either split or moved to one side.

By using a bar instead of a spade the ground about the corner is not disturbed and tamping is more effective.

It was found difficult to pull these posts out. Some 440 of them were planted in every kind of ground without using a spade.

The bars are made of good iron pipe and would be serviceable for another two or three hundred posts each.

The twenty-four inch iron posts appear to be very efficient for their purpose.

From a man who has been using the post that is an opinion that deserves consideration. The top is marked with a punch. It is very easily done, I have seen it done myself and it is a very quick operation. Of course it could be marked with a chisel. The United States post is a specially fine post, there cannot be any two opinions about that. There may be some doubt about the permanency of the brass top. Brass and iron may not get along well together; there is chemical action between the two in the presence of water, but perhaps they will last long enough. I do not know that we should have anything as elaborate as this, perhaps it is a little more than we require, but we certainly want something better than we have. After thinking the matter over it seems to me that the opinion of Mr. Melhuish deserves consideration. A plate of two and a half inches diameter on the bottom, with a good post on top of that and a brass cap on it, would make a good post and it ought to be possible to make a hole for receiving it without too much trouble. A kind of crow bar was used by Mr. Melhuish to make the hole, but some kind of an augur could be found to drill the hole. If we could drill a hole say three inches in diameter, that should be suitable for the post. We could tamp the earth down around it and it should make a very permanent mark. A good feature of the American post, is that the pipe is filled with concrete so that if the pipe itself is destroyed by rust you still have the concrete cylinder which remains to mark the corner and that will last forever. I think we should not mind the question of expense in making a permanent corner. The difficulty of transportation is a serious one. I can understand that a contractor would look at that side of the question, but I do not see why we should not go to the expense of getting a good permanent monument that will last forever.

THE CHAIRMAN: How long has that post been used in the United States?

DR. DEVILLE: I think it is quite recent. The United States general land office changed their method about four or five years ago. They have abandoned the contract system and now all surveys are made by the day, I think the change dates from about that time.

MR. AKINS: A large post like that with a plate on the bottom would serve another purpose also on the base line, as it could be used for bench marks, and it would be as permanent as the post we are using now. This every half mile would guarantee a good bench mark at each end and it would be possible to take a good elevation.

MAJOR HUBBELL: Would the cost be excessive?

DR. DEVILLE: No, these are very cheap posts. My recollection is that this one cost one dollar and a half, or something like that. The chief item of cost would come in the transportation.

MR. WATT: It seems to me that the planting of a post where a hole would have to be dug would lead to certain difficulties. I do not quite see how the ordinary man could dig a hole and put a post in the place where it was intended to be. He might get it in satisfactorily enough for the purpose of the base line surveyor, but say in the Yukon, I do not believe that it would be possible to get them in with sufficient accuracy to start the meridian from.

MAJOR HUBBELL: I think that the suggestion of the Surveyor General that an auger should be used is a good one.

MR. LONERGAN: The kind of auger used for boring coal in columns would possibly be suitable for boring such a hole.

MR. DODGE: Mr. Watt described to me a very ingenious method the telephone companies have for driving posts.

MR. WATT: I had the method partially explained to me. It is used in the case of corner poles where there is considerable strain and they have to put a tie in. Formerly they put in a trench with a dead man. Now they have a fairly large pipe, two or two and a half inches in diameter and down it they have a wire. The wire is attached to a barb of some kind. They drive the wire down with the post and as soon as they put the strain on the wire the barb opens. If it were used all that would be necessary would be to put a screw plug on top of the post.

MR. STEEL: It seems to me the main difficulty with most of the posts suggested is the planting of them in the different positions, which we encounter in our survey. If a hole has to be dug with a spade it takes so long that it will delay the whole work, the transit man will have to remain long enough on the spot to line in the posts. If the post is not lined in, of course the difficulty occurs, which I think Mr. Lonergan mentioned, that the posts are not in a position for meridians. The idea occured to me that if posts were used with a plate on the bottom the posts might be placed in the centre of the mound and the mound built around them. The posts could be lined in when the position was located and the mound built at any time afterwards. It seems to me that an auger would not be very suitable. Many of our surveys now are done in the bush and there would be great trouble with roots and in many cases with stones.

Major Hubbell: The objection to a mound is that when settlers put up fences they tear the mound down to get the posts in.

If it is the intention of Dr. Deville that we should make any official report on the posts it would be well to have a committee.

Dr. Deville: Perhaps it might be a good idea, although, that was not my intention in sending the post here, I simply sent it for the information of the members. In reply to the objections that were made in respect to the difficulty of planting these posts, I would remind you that the Americans are planting their posts which are very much more difficult to plant than any suggested for us, and I would think that what the Americans are doing we should be able to do. Perhaps their post is more elaborate than what we want, something a little less heavy would be good enough for the purpose. I do not think that any post which is planted without making a hole will be satisfactory. You have to have something flat at the bottom and your post must be long enough. A short post would not do because it would be pulled out by frost. The length ought to be thirty inches at least.

Mr. Lonergan: The trouble with the spade is to get the post in the proper place. The surveyor might first mark the place and then have a ring with two strings attached, with stakes at the end of the string. They could place the rings in the proper positions and then stretch out the string and drive the stakes and then when the post was put in the hole, adjusted by means of the rings.

Dr. Deville: A good boundary post should be flush with the ground. If you have something projecting over the ground it is an inducement to pull it out.

It was moved by Major Hubbell, seconded by Mr. Dodge: That a committee be appointed to examine and report upon the post submitted, the committee to consist of Mr. Akins, Mr. Lonergan, Mr. Steel and Mr. Watt.

REPORT OF A COMMITTEE, APPOINTED AT THE ANNUAL MEETING OF THE DOMINION LAND SURVEYORS ASSOCIATION, HELD IN OTTAWA, JANUARY, 1915, TO INQUIRE INTO THE MATTER OF A BETTER POST FOR USE ON DOMINION LAND SURVEYS.

The Committee have met on several occasions and considered the matter carefully, and although they have not as yet been able to obtain all the information they desired, they beg to report that, in their opinion:—

1. A post might be designed with an expanded or bulbous portion on its lower end, which could be driven flush with the ground, and which would in a very large percentage of cases be proof against removal without a shovel or other tools.

2. If the principal requirement of the desired post be that it can not be removed under any circumstances without spade or shovel, that of all the posts of which the Committee are aware, the one with a plate on the lower end is the most practical.

3. For frozen ground it will be advisable to carry special tools.

4. If the work is not to be delayed extra help will be necessary.

Apart from the question of transportation and the difficulty of planting the post correctly on line and to a depth of thirty inches (due to roots, gravel, boulders, frozen ground and water, especially in the spring of the year) there is no question but that the best post is one modelled after the pattern of those used on the United States surveys.

The question of transportation, however, is a serious one, (especially where work is to be done by man packing) and should not be lost sight of when deciding on the post to be used. Where transportation is done by horses, the difficulty could be overcome by supplying additional horses.

When the ground is frozen, as it is for the greater part of the year in northern Canada, an extra man would be required for each transit party to plant the post. This man should be intelligent and honest, and even then the surveyor will have to exercise great care to insure the posts are placed correctly on line.

It is the unanimous opinion of the Committee that on account of transport difficulties, the plates for the top and bottom of the post should not, on any account, be permanently fastened to the post till the camp is reached from which the posts will be placed. If the surveyor himself is held responsible for the assembling of the post, as he can easily be, before it goes on the line at all, there would be no danger of the plates not being used. Although many ways of construction might be adopted, the one we suggest is as follows: A post of one-half inch pipe, not less than twenty inches and not more than thirty inches long, a bronze top to be secured to post by a through rivet, a lower plate of three inches to four inches diameter, secured by a through rivet or held between a ring or knob worked on the post and the end, which could be rivitted or burred over.

If the post is to be filled with concrete it should be done before being supplied to the surveyor, and it is recommended that this part of the work be not done by contract, but by some officer of the Department, as being the only way of ensuring a job worth the trouble.

Referring to the tools necessary to dig the hole in frozen ground: The Bell Telephone Company have tried every known method, even using gasolene power drills and gunpowder. The only satisfactory method, and the one now used by them, is to employ a drill of octagon steel, about one inch diameter, and nine feet long, on each end of which is worked a hardened drill shaped chisel. A spoon shovel is used for removing the earth. Two difficulties have to be overcome before these tools can be made suitable for use on surveys: That of transporting the long drill rod and that of sharpening the tool when dulled. These difficulties might be partially overcome by having the bar made in two sections and extra bits for screwing on the rods as they become dulled with use. As the joints must be very strong and tight on account of the jarring and prying which the bar will have to undergo in use, it would be necessary to make the joints large and heavy, and it might be even advisable to apply heat in placing or removing the ends to secure a tight joint.

A post hole auger might be used in places in the summer, after the ground is thawed.

In the winter and at all times when the ground is frozen, there is no question that on a base line party another man would be required to place the post and that for the extra weight to be carried, and on account of the party being increased by the addition of one man, that two more horses would be required.

On subdivision work, it is probable that the addition of an extra man for each transit party and one extra horse would be sufficient.

I. J. STEELE.
GEO. H. WATT.
G. J. LONERGAN.
J. R. AKINS.

ELECTION OF OFFICERS.

The following officers were elected:—

President, Mr. A. H. Hawkins; Vice-President, Mr. J. A. McArthur.

Major Hubbell: I would suggest that the present members of the executive committee be given another term. These gentlemen have shown interest in the Association, we have had three executive meetings this year, and whatever they have been asked to do in the way of suggestions or advice they have responded most heartily. I do not think we could do better than re-elect those three gentlemen.

Secretary-Treasurer, Major Hubbell.

Vote of Thanks to Retiring President.

Mr. Bray: I think I voice the sentiments of the whole Association when I say, that we should return very hearty thanks indeed for the services of our retiring President, Mr. Aylsworth. He has filled the position very well indeed, and I wish to move a vote of thanks to him.

Mr. Brownlee: I am somewhat of a nuisance here, but I have derived a lot of pleasure out of the meeting, and it has given me a lot of new life and enthusiasm. I heartily second the resolution. It has been a joy to me to come here and see old faces and new faces.

Motion agreed to.

The Chairman: I thank you very much gentlemen.

The meeting adjourned.

The Annual Banquet.

The Annual Banquet of the Association was held at the Chateau Laurier. The Chair was occupied by Dr. Otto Klotz.

The Toast of the King having been duly honoured, the Chairman said: Gentlemen, the only formal Toast I have been asked to propose is one in which we are all interested, one in which the people of Canada are interested, the Department of the Interior. I am sure I am voicing your sentiments when I say we are fortunate in having a Minister presiding over that Department, second to none. That Department is of interest not only to us personally, but to the people of Canada and mostly concerns our vast Northwest, on which the future of Canada depends more perhaps than on any other part of the country, and it is therefore with great pleasure that I ask you to drink to the health of the Department of the Interior, coupling with the name of the Department that of the Minister, the Hon. Dr. Roche.

Hon. Dr. Roche on rising to respond, was loudly cheered.

He said: I must thank the chairman in the first place for his very flattering personal reference, and I must thank you for the cordial manner in which you have greeted this Toast. This is the second occasion on which I have had the privilege and the pleasure of being present at your annual banquet. When I was here last year I remember apologizing for my absence at your preceding banquet, after having accepted your invitation, owing to the fact that I had myself to submit to a survey of my interior department and I was congratulating myself on that occasion that probably I would not have to undergo a similar ordeal in the future. However, man proposes and God disposes. I am glad to say that through the mercy of a Divine Providence, as well as through the skill of the surgeons into whose hands I trusted my life, to say nothing of the personal determination on my own part to submit to such an ordeal, that after all the Lord helps those who help themselves. I am pleased to be with you this evening. Little did we think when we assembled around the festal board at your last annual banquet, that within a few short months nearly all Europe would be engaged in a life and death struggle for national existence, in which Canada would be taking so very conspicuous and so very important a part. Under the circumstances, therefore, we are not meeting to-night under as favourable auspices in this respect as we otherwise would, and still while no doubt we deplore the great sacrifice of life and property in the great contest now going on in Europe, we should, with stout hearts and the courage characteristic of Canadians look forward with the very greatest optimism to the future. Such gatherings as you have this evening are intended and calculated to do a considerable amount of good, not only from the standpoint of the individual members of your staff, but also by creating and perpetuating the spirit of harmony that is so essential in order to attain the greatest amount of good from a meterial standpoint. In the hurly burly of everyday life we are all so busily engaged looking after our own affairs, fishing after the prizes of life, setting aside everyone in our way who is not strong enough to push us aside, that we sometimes disregard the social side of human nature, nay, even sometimes neglect the ordinary courtesy and amenities of human life. Therefore I think it quite commendable that the Association of Dominion Land Surveyors should have their annual banquet and assemble around the social board, and fraternize with each other and pass a pleasant hour or two, the pleasure of which I am sure will be felt for many months to come.

Now owing to the great financial stringency which exists at the present time, intensified as it is by war conditions, we in Canada are having our day of trial which is testing the resources and the capacity of the Canadian people. Yet we have had our days of trial in years gone by, at a time when Canada was not in as good condition to stand up under the burden as she is to-day, and notwithstanding that fact we were able to overcome those trials and difficulties with but a temporary setback; and surely we as Canadians are as competent, as courageous and have as great capacity to-day as in days gone by. So with our boundless resources we look forward with every confidence to the recuperative powers of our country and a speedy restoration to normal conditions. When we compare our country with little Belgium we have every reason to congratulate ourselves. Poor little Belgium has been shamefully treated, and why? What has been done, what crime committed? Just because the people of that country desired to defend themselves and protested against the ruthless step of the invader, her fields have been laid waste, her beautiful cities and towns with all their treasures of art and science and industry, have been destroyed, her men have been slaughtered for defending their homes and families, and worse still, her dear ones, the wives and children of these brave men, have been mutilated and slaughtered. To-day they are homeless, a wandering people, hundreds and thousands of them in their own country without a roof, with little clothing and with little food, save that which is supplied them through charity. To-day tens of thousands of them are refugees in other countries such as England, France and Holland, and are being cared for by the people of those countries. What was their crime? Because, as it has been well put, they trusted to the honour and the word of a Prussian King. We all know that the German army invaded Belgian territory in order to gain time. Speed was, in their opinion, their greatest asset. On to Paris was their Shibboleth, and we know that after all they did not gain time. But Oh! what have they lost? They have lost their good name which should be the greatest asset of any self respecting people. This war of aggression that is being carried on to-day on the part of Germany we know has been long preparing; the most powerful engines of destruction have been created by a war-mad people. We know that there has been inculcated into the minds of the people of that country a disdain of the right, and there has been a persistent endeavour to banish all feelings of humanity from their hearts. They thought that they had foreseen everything, but they had not foreseen that they would come in conflict with the conscience of almost all of the civilized world in this murderous war, the most terrible in the history of the world. We all know the real, deep soul, the true soul of Germany did not reveal itself when the wheels of the ruthless machine were rolled over Belgium, leaving the ghastly trail of ruin and of suffering humanity; nor when the Moslems were incited to a holy war, to rise and murder Christians; nor when the rich and chaste tower of Rheims cathedral, that symphony in stone, was powdered to dust: nor when the ordinary rules of civilized warfare were ignored and war made on defenceless seaport towns without giving notice. These were the acts of a blood drunk caste that by its astute patriotism had chained a noble race to its chariot and the warring nations of the earth cannot and should not close until the menace of this murderous ogre has been shorn of its power and the true soul of Germany has been restored to its right. The war, therefore, which is being carried on by the Allies is not one in the interest of these respective countries alone, but is for the redemption as well, of the real true Germany which all men honoured, from the military caste, which to-day dominates it. But this cannot be accomplished without the sacrifice of millions of useful lives. So far as we, the British Empire, are concerned, I think it was Winston Churchill, who in a speech some months ago made the remark that the English bull dog's nose was slanted backwards for the express purpose that when he got a good grip he might be able to hold on without interfering with his respiratory operations. The English bull dog has his hold on the throat of Prussian militarism to-day, and what we have we'll hold. So far as Canada is concerned, Canada is an integral part of the British Empire. The Empire's interests are our interests, and in the defence of these interests Canadians will not be found wanting. We have prided ourselves in years gone by on being a nation, on the wonderful progress and prosperity which we as a country have enjoyed. But what was it that assured us of that prosperity? First I would admit it is the industry of the Canadian people, but that alone would not have accomplished it, had it not been for British gold and for the protection which was assured Canada by the British navy. So I say that now that we have come to years of security we should rally and will rally around the flag of the Motherland to uphold her arms and those of her Allies in this gigantic struggle that she is carrying on in the interests of humanity and of freedom and of civilization. You must excuse me for dwelling so much upon this war because as I intimated one's mind and one's heart is wrapped up in the war. I thank you most kindly for your courtesy in extending an invitation to me to be present. I think it only right that the head of the Department should be present at as many of these functions as possible, in order that he may keep in touch with the men who are doing important work for the Department. I wish your Association of Dominion Land Surveyors that success which I am sure they merit and richly deserve.

Brief addresses were also delivered by Mr. Bradbury, M.P.; Mr. Aylsworth; Mr. Brownlee; Mr. McDiarmid, President of the Astronomical Society; Colonel Arnoldi; Major Rothwell; Mr. A. E. Fripp, M.P.; Mr. Campbell, Director Supt. of Forestry; Major Hubbell and the Chairman. A number of songs were sung by Mr. Parkinson.

OBITUARY.

It is the sad duty of this Association to chronicle the death, by drowning, of one of its members during the past survey season. The late Albert Ernest Hunter, D.L.S., of Wiarton, Ontario, was the unfortunate victim. He had charge of a party camped at Keefers, B.C., and was engaged on township sub-division and retracement surveys when he met with the sad accident which cost him his life.

On the morning of July 14th, 1914, he, with two axemen were engaged in producing the north boundary of section 5, township 12, range 26, west of 6th meridian, across the Salmon or Nahatlatch River, three miles south of Keefers. In an endeavour to reach the bank of the Salmon River, he lost his footing and slipped over a rough jagged cliff, a height of about 100 feet, into the boiling rapids of the Salmon River beneath. The two axemen who were otherwise engaged, did not see him fall, but on discovering he was missing a few minutes later, they made a search which showed only too plainly what had happened the unfortunate man.

A searching party composed of two brothers of the deceased, the survey party, and some Indians with canoes searched the mouth of the Salmon River for eight days for the body, and were finally rewarded. The remains were shipped to the home of deceased in charge of the two brothers, and the funeral was held there on July 28th.

Albert Ernest Hunter or "Ernie" as he was popularly known, was just 26 years of age. He was born at Wiarton, Ontario, where he received his Public and High School education. In 1905 he entered the School of Practical Science, Toronto, as a freshman in the Civil Engineering course, and graduated in 1909 with honors. After graduation he engaged in survey work and was with Mr. O. D. Rolfson, D.L.S. as an assistant, during the seasons of 1910 and 1911, on surveys in Alberta. In 1912, he was D.L.S. assistant to Mr. A. Saint Cyr, D.L.S., on base line surveys north or west of Prince Albert, and remained in the field until the spring of 1913, when he received an appointment to take charge of a party on surveys of Dominion Lands in the Railway Belt of British Columbia. He was engaged on miscellaneous sub-division and retracement surveys in the vicinity of Spuzzum, B.C., and he also laid out the townsite of Spuzzum. In 1914, he was again instructed to take charge of a party to make miscellaneous sub-division and retracement surveys in the vicinity of Lytton, B.C., and it was while engaged on this work that he met with the terrible accident above described.

The late Mr. Hunter was an energetic and careful surveyor, and although of a quiet and retiring disposition, he was held in high esteem by the members of his party, and by all with whom he came in contact. He was perhaps not very widely known among surveyors, having spent his time when not engaged on field work, at his home in Wiarton. He was an enthusiastic sportsman, being specially notable as a lacrosse player. In religion he was a member of the Church of Christ.

The members of his family left to mourn his loss are his mother and father, Mr. and Mrs. Jas. Hunter, of Wiarton, his sisters, Mrs. Captain Tyson, of Wiarton, and Mrs. P. J. Jermyn, of Toronto, and his brothers, Gordon S. Hunter, of Saskatoon, Sask.; W. Frank Hunter, of Gull Lake, Sask., D. J. Hunter, of Wiarton, and Roy C. Hunter, late of Vancouver, but who has now left for the front with the 23rd Provisional Battalion, of the Canadian Expeditionary Forces.

At the annual meeting of this Association, a motion was passed, instructing the Secretary to convey to the family, the heartfelt sympathy of the Association.

ROLL OF HONOUR IN CANADIAN FORCE.

ENLISTED WITH FIRST, SECOND OR THIRD CONTINGENTS, (21).

ALPORT, F., D.L.S.
BOLTON, L. E. S., D.L.S.
BROWN, E. F., D.L.S.
CLARKE, R. F., D.L.S.
EARLE, W. S., D.L.S.
ELLIS, D. C., D.L.S.
GARNER, A. C., D.L.S.
GORDON, M. L., D.L.S.
HAGGEN, R. W., D.L.S.
HUBBELL, E. W., D.L.S.
LAURIE, R. C., D.L.S.
MALCOLM, L., D.L.S.
MACLEOD, G. W., D.L.S.
McDONALD, H., D.L.S.
NESHAM, E. W., D.L.S.
PARSONS, J. L. R., D.L.S.
PINDER, G. Z., D.L.S.
SAUNDERS, B. J., D.L.S.
SHEPPARD, A. C. T., D.L.S.
SMITH, D. A., D.L.S.
STOCK, J. J., D.L.S.

LIST OF MEMBERS.

HONORARY MEMBERS.

Hon. Patron:

Deville, E., LL.D., D.T.S., Surveyor-General, Interior Dept., Ottawa.

Hon. President:

King, W. F., C.M.G., LL.D., D.T.S., Chief Astronomer, Interior Dept., Ottawa.

Hon. Members:

Casgrain, Hon. J. P. B., D.L.S., Senator, The Senate, Ottawa.
Magrath, C. A., D.T.S., International Waterways Commission, Ottawa.
Dennis, J. S., D.T.S., Commissioner of National Resources for C.P.R., Montreal.
Klotz, Otto, D.Sc., D.T.S., Assistant Chief Astronomer, Interior Dept., Ottawa.
Stewart, W. J., Chief Hydrographer, Marine Dept., Ottawa.
Campbell, R. H., Director of Forestry, Interior Dept., Ottawa.
Symes, P. B., Cor. Lyon & Somerset Sts., Ottawa.

Past Presidents:

Hubbell, E. W., D.L.S., 1907-08.
Young, R. E.,. D.L.S., 1909-1910.
Fawcett, Thos.,D.L.S., 1911.
Belanger, P. R. A., 1912.
Miles, C. F., D.L.S., 1913.
Aylsworth, C. F., D.L.S., 1914.

Date of
Election.

LIST OF ACTIVE MEMBERS.

1912—Akins, J. R., D.L.S., Dunvegan, Alta.
1907—Aylsworth, C. F., D.L.S., Madoc, Ont.

1913—Baird, W. J., D.L.S., Scarboro P. O., Ont.
1914—Baker, M.H., D.L.S., St. Thomas, Ont.
1910—Barber, H. G., D.L.S., Interior Dept., Ottawa.
1907—Bayne, G. A., D.L.S., c|o Hudson's Bay Company, Winnipeg.
1907—Beatty, D., D.L.S., Parry Sound, Ont.
1915—Beatty, F. W., D.L.S., Pembroke, Ont.
1912—Bennett, G. A., D.L.S., Eden, Ont.
1914—Beresford, H. E., Portage la Prairie, Man.
1913—Berry, E. W., D.L.S., The Rectory, Seaforth, Ont.
1910—Bigger, C. A., D.L.S., Geodetic Survey, Ottawa.
1909—Bingham, E. R., D.L.S., 418 Victoria Ave., Fort William, Ont.
1911—Blanchet, G. H., D.L.S., 110 Frank St., Ottawa, Ont.
1915—Bolton, L. E. S., 281 Lisgar St., Ottawa.
1913—Boulton, W. J., D.L.S., Mattawa, Ont.
1907—Bourgault, C. E., D.L.S., St. Jean Port Joli, P.Q.
1910—Bourgeault, A., D.L.S., St. Jean Port Joli, P.Q.
1912—Bowman, E. P., D.L.S., West Montrose, Ont.
1907—Brabazon, A. J., D.L.S., Interior Dept., Ottawa.
1909—Brady, Jas, D.L.S., Golden, B.C.
1907—Bray, L. T., D.L.S., Edmonton, Alta.
1910—Bray, S., D.L.S., Indian Dept., Ottawa, Chief Surveyor.
1910—Brenot, L., D.L.S., 137 Third Avenue, Ottawa, Ont.
1910—Bridgland, M.P., D.L.S., Box 257, Calgary, Alta.
1912—Brownlee, J. H., D.L.S., Dawson, Yukon.
1913—Buchanan, T., D.L.S., 140 Jasper Ave., Edmonton, Alta.
1907—Burgess, E. L., D.L.S., Victoria, B.C.
1912—Brown, Thos. W., Box 438, Saskatoon, Sask.

1912—Calder, J. A., D.L.S., Ashcroft, B.C.
1913—Cannell, H. W., D.L.S., Dept. Interior, Ottawa.
1915—Campbell, A. J., D.L.S., Sidney, B.C.
1911—Campbell, A. S., D.L.S., Cor. King and Brock Sts., Kingston, Ont.
1913—Carthew, J. T., D.L.S., Edmonton, Alta.
1913—Carthew, W. M., D.L.S. Edmonton, Alta.
1909—Cautley, R. W., D.L.S., 523 Sixth St., Edmonton, Alta.
1912—Chase, A. V., D.L.S., Orillia, Ont.
1913—Christie, U. W., D.L.S., Interior Dept., Ottawa.
1910—Christie, Wm., D.L.S., Box 74, Prince Albert, Sask.
1914—Clarke, R. F., D.L.S.
1912—Clements, F. S., D.L.S., Box 49, Prince Rupert, B.C.
1909—Cleveland, E. A., D.L.S., Flack Block, Vancouver, B.C.
1910—Clunn, T. H. G., D.L.S., Interior Dept., Ottawa.
1909—Cochrane, M. F., D.L.S., Interior Dept., Ottawa.
1913—Coltham, Geo. W., D.L.S., Box 264, Aurora, Ont.
1907—Coté, J. L., D.L.S., Edmonton, Alta.
1913—Coté, J. M., Ottawa, Ont.
1914—Coté, J. A., Interior Dept., Ottawa.
1910—Cotton, A. F., D.L.S., New Westminster, B.C
1912—Cowper, G. C., D.L.S., Welland, Ont.
1909—Craig, J. D., D.L.S., Interior Dept,, Ottawa.
1913—Cummings, A. F., D.L.S., Fernie, B.C.

Date of
Election.

ACTIVE MEMBERS—Continued.

1910—Cumming, A. L., D.L.S., Hotel Cecil, Edmonton, Alta.
1907—Currie, P. W., D.L.S., Interior Dept,. Ottawa.

1911—Davies, T. A., D.L.S., 52 McDougal Ave,. Edmonton, Alta.
1911—Day, H. S., D.L.S., Marchand Apartments, Edmonton, Alta.
1908—Deans, W. J., D.L.S., Inspector of Surveys, Brandon, Man.
1912—de la Condamine, C., D.L.S., Box 1774, Calgary, Alta.
1911—Dennis, E. M., D.L.S., Interior Dept., Ottawa.
1912—Dennis, M., D.L.S., Interior Dept., Ottawa.
1907—Dickson, H. G., D.L.S., Whitehorse, Yukon.
1912—Dillabough, J. U., D.L.S., c|o Chief Engineer, H. B. C., Winnipeg, Mar.
1909—Dodge, G. B., D.L.S., Interior Dept., Ottawa.
1913—Donnelly, Cecil, D.L.S., 343 Carlton St., Winnipeg, Man.
1913—Dozois, L. O. R., Box 1774, Calgary, Alta.
1910—Drummond, T., D.T.S., 119 St. Matthew St., Montreal.
1909—Ducker, W. A., D.L.S., 144 Smith St., Winnipeg.
1907—Dumais, P. T. C., D.L.S., Hull, P.Q.

1911—Earle, W. S., D.L.S., Grand Trunk City Office, Victoria, B.C.
1913—Edeskoly, Von J., D.L.S., 17 Inns. of Court Bldg., Vancouver, B.C.
1909—Edwards, Geo., D.L.S., Ponoka, Alta.
1913—Edwards, W. M., University of Alberta, Edmonton.
1913—Elliott, G. R., Calgary, Alta.
1907—Engler, C., D.L.S., Interior Dept., Ottawa.
1912—Evans, S. L., D.L.S., Corinth, Ont.
1914—Ewing, E. O., D.L.S., Toronto, Ont.

1910—Fairchild, C. C., D.L.S., 54 Brant Ave., Brantford, Ont.
1907—Fawcett, A., D.L.S., Gravenhurst, Ont.
1907—Fawcett, Thos., D.T.S., Boundary Surveys, Ottawa.
1914—Fawcett, S. D., D.L.S., Bayswater Avenue, Ottawa.
1915—Finnie, O. S., D.L.S., Interior Dept., Ottawa.
1910—Ferguson, G. H., D.L.S., Commission,of Conservation, Ottawa.
1911—Fletcher, J. A., D.L.S., Interior Dept., Ottawa.
1915—Fletcher, W. A., D.L.S., Thornton, Ont.
1907—Fontaine, L. E., D.L.S., Inspector of Surveys, Levis, P.Q.
1913—Francis, J., D.L.S., Portage la Prairie, Man.

1911—Galletly, J. S., D.L.S., Peace River Crossing, Alta.
1909—Garner, A. C., D.L.S., 2133 Cameron St., Regina, Sask..
1914—Gass, Lawrence, D.L.S., Iroquois, Ont.
1908—Gibbon, Jas., D.L.S., 1631 Collingwood St., Vancouver, B.C.
1913—Glover, A. E., D.L.S., 140 Jasper Ave., West, Edmonton, Alta.
1913—Grassie, G., Medicine Hat, Alta.
1913—Griffith, A. D., D.L.S., 104 Walnut Ave., Winnipeg.
1907—Grover, G. A., D.L.S., 24 King St. West, Toronto.
1910—Gordon, M. L., D.L.S., 619 Hastings St., Victoria, B.C.
1914—Gourlay, Robt. M., D.L.S., 75 King St. E., Toronto.

1913—Hamilton, Chas. T., D.L.S., 1001 Rogers Bldg., Vancouver, B.C.
1911—Haggen, R. W., D.L.S., Revelstoke, B.C.
1914—Hardoin, Jos., D.L.S., Winnipeg, Man.
1913—Harris, J. W., D.L.S., City Engineer, Winnipeg, Man.
1910—Harvey, Chas., D.L.S., Kelowna, B.C.

Date of
Election.

ACTIVE MEMBERS—Continued.

1907—Hawkins, A. H., D.L.S., Listowel, Ont., President.
1907—Heathcott, R. V., D.L.S., Edmonton, Alta.
1913—Hemperman, L. F., D.L.S., Phoenix, Ariz., U.S.A.
1907—Henderson, F. D., D.L.S., Interior Dept., Ottawa.
1911—Herriot, G. H., D.L.S., Souris, Man.
1911—Higgins, C. J., D.L.S., Box 986, Vancouver, B.C.
1912—Hobbs, W. E., D.L.S., Winnipeg, Man.
1907—Holcroft, H. S., D.L.S., 105 St. Vincent St., Toronto.
1907—Hopkins, M. W., D.L.S., Edmonton, Alta.
1907—Hubbell, E. W., D.L.S., Secretary, Chief Inspector of Surveys, Dept. of the Interior, Ottawa.

1911—Inkster, O., D.L.S., Edmonton, Alta.

1909—Jephson, R. J., D.L.S., Box 986, Brandon, Man.
1913—Johnston, R. H., 10162–116th St., Edmonton, Alta.
1911—Johnston, W. J., D.L.S., 73 Exchange Building, 142 Hastings Street, Vancouver, B.C.
1912—Johnston, J. H., D.L.S., Peace River Crossing, Alta.
1912—Jones, G. S., D.L.S., Interior Department, Ottawa.

1915—King, J. A. S., D.L.S., 41 Somerset Street, Ottawa.
1907—Kirk, J. A., D.L.S., Summerland, B.C.
1911—Kitto, F. H., D.L.S., Interior Dept., Ottawa.

1912—Latimer, F. H., D.L.S., Pentington, B.C.
1913—LeBlanc, P. M. H., Ottawa, Ont.
1910—Lemoine, C. E., D.L.S., 111 Mountain Hill, Quebec, P.Q.
1911—Lighthall, A., D.L.S., 2328 Vine St., Vancouver, B.C.
1907—Lonergan, G. J., D.L.S., Inspector of Surveys, Buckingham, P.Q.
1912—Loucks, R. W. E., D.L.S., Delisle, Sask.
1907—Lumsden, H. D., D.L.S., 152 Argyle Ave., Ottawa.

1912—Martindale, E. S., D.L.S., Kings Mill, Ont.
1912—Martyn, O. W., D.L.S., Box 443, Swift Current, Sask.
1911—Matheson, H., D.L.S., Pocahontas, Alta.
1914—Morency, Geo., D.L.S., Levis, P.Q.
1914—Moran, P. J., 950 Jarvis St., Vancouver, B.C.
1909—McArthur, J. J., D.L.S., Boundary Surveys, Ottawa.
1912—McCaw, R. D., D.L.S., Surveyor-General's Branch, Victoria, B.C.
1912—McEwen, D. F., D.L.S., Grouard, Alta.
1910—McFadden, M., D.L.S., 1255 15th Ave. E., Vancouver, B.C.
1910—McFarlane, J. B., D.L.S., 60 Lonsdale Road, Toronto.
1908—McGrandle, H., D.L.S., Wetaskiwin, Alta.
1912—McKay, R. B., D.L.S., 1146 Pacific St., Vancouver, B.C.
1914—McKnight, J. H., D.L.S., Simcoe, Ont.
1913—McNaughton, A. L., D.L.S., Cronwall, Ont.
1913—McElhanney, W. G., D.L.S., Vancouver, B.C.
1907—McMillan, Geo., D.L.S., Calgary, Alta.
1912—Melhuish, P., D.L.S., 2328 Vine St., Vancouver, B.C.
1913—Milliken, J. B., D.L.S., Dept. Interior, Ottawa.
1907—Miles, C. F., D.L.S., Inspector of Surveys, Box 2253 Calgary, Alta.
1909—Moberly, H. K., D.L.S., Moosomin, Sask.
1909—Montgomery, R. H., D.L.S., Prince Albert, Sask.

Date of
Election.

ACTIVE MEMBERS—Continued.

1909—Morrier, J. E., D.L.S., Prince Albert, Sask.
1907—Mountain, G. A., D.L.S., Chief Engineer to the Railway Commission, Ottawa.

1911—Narraway, A. M., D.L.S., 197 Second Ave., Ottawa.
1912—Neelands, R., D.L.S., Hamiota, Man.
1909—Nelles, D. H., D.L.S., Boundary Surveys, Ottawa.
1912—Neville, E. A., D.L.S., 936 Granville St., Vancouver, B.C.
1915—Norrish, W. H., D.L.S., 55 Waterloo St., Guelph, Ont.

1910—Ogilvie, N. J., D.L.S., Boundary Surveys, Ottawa.

1913—Parry, H., D.L.S., Interior Dept., Ottawa.
1912—Palmer, P. E., D.L.S., 81 Summer St., St. John, N.B.
1910—Parsons, J. L. R., D.L.S., Box 1004, Regina, Sask.
1910—Patrick, A. P., D.T.S., Calgary, Alta.
1910—Pearce, Wm., D.L.S., Calgary, Alta.
1913—Pearson, H. E., D.L.S., Box 1077, Edmonton, Alta.
1913—Peters, F. N., D.L.S., P. O. Box 5, Calgary, Alta.
1907—Phillips, E. H., D.L.S., Saskatoon, Sask.
1911—Pierce, J. W., D.L.S., Pembroke, Ont.
1914—Pinder, G. Z., D.L.S., Credit Foncier Bldg., Edmonton, Alta.
1911—Plunkett, T. H., D.L.S., Whitehorn, Man.
1912—Powell, W. H., D.L.S., 420 Michigan St., Victoria, B.C.
1911—Purser, R. C., D.L.S., 32 Glengarry Ave., Windsor, Ont.

1911—Rainboth, G. L., D.L.S., 186 Cooper St., Ottawa.
1911—Ransom, J. T., D.L.S., 470 Manning Ave., Toronto.
1911—Reid, F. B., D.L.S., Geodetic Surveys, Ottawa.
1913—Reid, John, D.L.S., 161 Leonore St., Winnipeg, Man.
1907—Reilly, W. R., D.L.S., Regina, Sask.
1911—Rinfret, C., D.L.S., 26 Rue St. Jacques, Montreal.
1915—Roberts, O. B., D.L.S.,
1913—Robertson, D. F., D.L.S., Indian Affairs Dept., Ottawa.
1910—Robinson, E. W., D.L.S., Le Pas, Man.
1909—Rolfson, O., D.L.S., Box 378, Walkerville, Ont.
1907—Ross, Geo., D.L.S., Welland, Ont.
1910—Ross, J. E., D.L.S., Kamloops, B.C.
1907—Roy, G. P., D.L.S., 28 Lachevrotière St., Quebec.
1911—Roy, J. E., D.L.S., 28 Lachevrotière St., Quebec.
1908—Saint-Cyr, A., D.L.S., Box 1030, Prince Albert, Sask.
1907—Saint-Cyr, J. B., D.L.S., 189 Fabre St., Montreal.
1909—Saunders, B. J., D.L.S., Edmonton, Alta.
1910—Scott, W. A., D.L.S., Saskatoon, Sask.
1909—Seager, E., D.L.S., Kenora, Ont.
1912—Segre, B. H., D.L.S., Toronto, Ont.
1912—Seibert, F. V., D.L.S., 609 Spadina Ave., Toronto.
1910—Seymour, H. L., D.L.S., Interior Dept., Ottawa.
1907—Shanks, T., D.L.S., Asst. Surveyor General, Topographical Surveys Branch Ottawa.
1914—Shaver, P. A., D.L.S., Finch, Ont.
1912—Sheppard, H. C. T., D.L.S., Geological Survey, Ottawa.
1910—Shaw, C. A. E., D.L.S., Greenwood, B.C.
1912—Sirois, J. E., D.L.S., Box 26, Ste. Anne de la Pocatiere, Kamouraska, P.Q.

Date of
Election.

ACTIVE MEMBERS—Continued.

1908—Smith, C. C., D.L.S., Victoria, B.C.
1907—Speight, T. B., D.L.S., 703 Temple Building, Toronto.
1912—Soars, H. M. R., D.L.S., 637 First St., Edmonton, Alta.
1909—Steele, I. J., D.L.S., 18 Rideau Terrace, Rockliffe, Ottawa.
1912—Stewart, A. G., D.L.S., Hotel Cecil, Edmonton, Alta.
1912—Stewart, N. C., D.L.S., 936 Granville St., Vancouver, B.C.
1911—Stewart, W. M., D.L.S., Saskatoon, Sask.
1911—Stitt, O. M., D.L.S., 319 Pender St. W., Vancouver, B.C.
1913—Stock, J. J., D.L.S., Ottawa, Ont.
1911—Stuart, A. G., D.L.S., Buckingham, P.Q.
1911—Street, P. B., D.L.S., 17 Spadina Road, Toronto.

1914—Taylor, W. E., 323 Glen Road, Toronto.
1911—Taggart, C. H., D.L.S., Vancouver, B.C.
1908—Teasdale, C. M., D.L.S., Concord, Ont.
1913—Tipper, G. A., D.L.S., 196 Marlborough Ave., Brantford, Ont.
1912—Tremblay, A. J., D.L.S., Box 1077, Edmonton, Alta.
1907—Tyrrell, J. W., D.L.S., 7 Hughson St., Hamilton, Ont.
1912—Tobey, W. M., D.T.S., Ottawa, Ont.

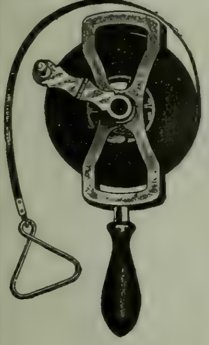
1911—Underwood, J. E., D.L.S., Saskatoon, Sask.

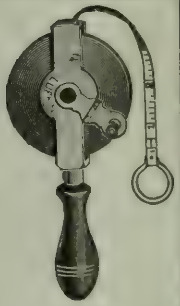
1913—Von Skiver, L. A., D.L.S., Fish Lake, Ont.

1913—Waddell, W. H., D.L.S., Edmonton, Alta.
1911—Walker, C. M., D.L.S., 24 Edward St., London, Ont.
1911—Wallace, J. N., D.L.S., Box 1774, Calgary, Alta.
1914—Warrington, G. A., D.L.S., Public Works, Winnipeg, Man.
1913—Waugh, B. W., D.L.S., Interior Dept., Ottawa.
1907—Weeks, A. S., D.L.S., 540 Sutherland St., Edmonton, Alta.
1910—Westland, C. R., D.L.S., Boundary Surveys, Ottawa.
1912—Whitcher, A. H., D.L.S., Secretary, Geographic Board, Ottawa.
1912—White, W. R., D.L.S., Indian Affairs Dept., Ottawa.
1912—Whyte, H. E., D.L.S., 620 North Park St., Victoria, B.C.
1912—Wright, A. E., D.L.S., Box 70, Prince Rupert, B.C.

DECEASED MEMBERS.

Joined the Association.	NAME.	Date of Death.
1907	Reid, J. L., D.L.S.	June 18th, 1911.
1907	Selby, H. W., D.L.S	August 23rd, 1910.
1907	Stacey, A. G., D.L.S.	June 4th, 1908.
1907	Young, R. E., D.L.S.	October 24th, 1911.
1908	Green, W. T., D.L.S.	November 1st, 1909.
1908	Ratz, W. F., D.L.S.	February 6th, 1909.
1909	McLean, J. K., D.L.S.	May 25th, 1913.
1909	Rainboth, G. C., D.L.S.	November 2nd, 1910.
1910	Mackie, F. H., D.L.S.,	December 23rd, 1912.
1912	Ogilvie, Wm., D.L.S.	November 13th, 1912.
1912	Hunter, A. E., D.L.S.	July 14th, 1914.
1912	Ponton, A. W., D.L.S.	January 21st, 1915.
1913	Johnson, C. E., D.L.S.	December 31st, 1913.





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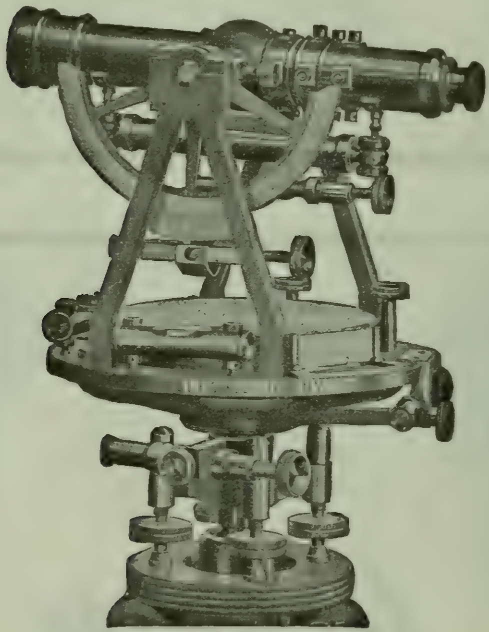

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